PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

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SUISSE

Date of mailing (day/month/year) 03 December 1999 (03.12.99)	
Applicant's or agent's file reference	**IMPORTANT NOTIFICATION**
International application No. PCT/IB99/00178	International filing date (day/month/year) 29 January 1999 (29.01.99)

1. The following indications appeared on record concerning:

[X] the applicant   [ ] the inventor   [ ] the agent   [ ] the common representative

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2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person   [ ] the name   [X] the address   [ ] the nationality   [ ] the residence

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3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority

[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Maria Victoria CORTIELLO
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002992058

Form PCT/IB/306 (March 1994)

(54) Title: SHIRWO SYSTEM (A NEW INTERNAL COMBUSTION POWER SYSTEM)

(57) Abstract

Engine using wheels rotating inside the engine case, these wheels contain cylinder with its pistons which have the abilities of linear movements inside each cylinder, all wheels fixed on the same straight main crank shaft, each wheel conducted separately with its seals, valves, spark plug and exhaust pipe. The cylinder placed in center-side of each wheel as the required discipline for each engine design, each contains piston with design relevant flexible elastic push-arm, the chamber for each cylinder is in the circumference zone of wheel. The air-fuel mix charged in pressured situation from outside by the required accessories, by a valve away from firing portion, the wheel circumference guarded by anti-gas seal in three portions or more fixed in the case to separate mod of the chamber mix zone (stoke situations) during the work of the engine.

TO: **USPTO**
U.S. DEPARTMENT OF COMMERCE
Washington , DC 20231 USA

<u>Geneva on 26 July 2000</u>

Gentlemen ,

Sub./ Requesting to grant US Patent

Please accept my International PCT Amended Application to enter USPTO regional phase to grant a patent , please record this information :

Int. App. No, PCT/ IB99/00178

The Int. Priority date , 30-01-1998   ,   The Int. Filing date , 29-01-1999

The title of the invention ,
SHIRWO S. (A NEW INTERNAL COMBUSTION POWER SYSTEM).

The analyses of this amended application , a total of 70 pages .

A text matter of 45   pages
Description in   36   pages
The claims in   7   pages
The abstract in   2   pages
The drawings set in   25   pages (1/25 -25/25)

The claims of this invention are   **30 claims** .

The address of the inventor is .

8 Rue David-Dufour
Ch-1205 Geneva
SUISSE, SWITZERLAND

The inventor is hereby accept with his consent to enter the USPTO with another US resident applicant which is the Kurdistan regional Government official Rep. In USA.

This application will be confirmed later on by the inventor's actual signature on the official USPTO application documents when it will be sent to the inventor . This letter has been sent by Fax to be reached in the right valid time concerning PCT to enter USPTO and this letter will be sent by mail also.

Yours Truly

AL PASHA AL BANDAINI Shirwan

KURDISTAN REGIONAL GOVERNMENT
ERBIL-IRAQ 534 Rec'd PCT... 27 JUL 2000
09/582634

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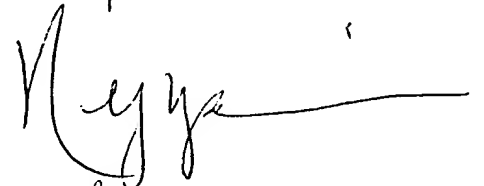**US Representative**

Receipt

Filed in US PTO Office on July 27, 2000 The following:

A — First page published PCT APPN. # WO99/39090

B — 3 Pages of International Search Report for (PCT IB99/00178)

C — A Letter to USPTO Dated 26 July, 2000

D — Notification of Recording of a Change.

E — Receipt

F — PTO 1390, 2 pages.

G — Check # 1405 in The amount of $840.00

Nijyar Shemdin

July 27, 2000

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(54) Title: SHIRWO SYSTEM (A NEW INTERNAL COMBUSTION POWER SYSTEM)

(57) Abstract

Engine using wheels rotating inside the engine case, these wheels contain cylinder with its pistons which have the abilities of linear movements inside each cylinder, all wheels fixed on the same straight main crank shaft, each wheel conducted separately with its seals, valves, spark plug and exhaust pipe. The cylinder placed in center-side of each wheel as the required discipline for each engine design, each contains piston with design relevant flexible elastic push-arm, the chamber for each cylinder is in the circumference zone of wheel. The air-fuel mix charged in pressured situation from outside by the required accessories, by a valve away from firing portion, the wheel circumference guarded by anti-gas seal in three portions or more fixed in the case to separate mod of the chamber mix zone (stoke situations) during the work of the engine.

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6   F02B75/26   F02B57/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6   F02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 252 764 A (COIGNARD) 20 June 1975 (1975-06-20)	1-10, 20-22, 27,29, 30,32
A	figures 1,2 page 2, line 14 - page 4, line 15	14-18, 23,24

X	FR 2 229 274 A (BOEUF PAUL) 6 December 1974 (1974-12-06) figure 1 page 1, line 1 - page 2, line 20	1-10,26, 31,32

A	US 4 127 096 A (TOWNSEND RAY T) 28 November 1978 (1978-11-28) figure 1 abstract column 6, line 16 - line 38	1,11,15, 19

-/--

| X | Further documents are listed in the continuation of box C. | | X | Patent family members are listed in annex. |

Date of the actual completion of the international search	Date of mailing of the international search report
25 May 1999	13 0. 08. 99

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	WASSENAAR, G

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	AU 59802 86 A (BULLMORE E A) 15 January 1987 (1987-01-15) figures 1-3 abstract claims 1-10	1,11,15, 30-32

A	NL 7 310 257 A (JOHANNES HALFHIDE PR BEATRIXHO) 28 January 1975 (1975-01-28) figures 1-3 claims 1-7	1-10

A	FR 2 086 778 A (LE DUIGO ROGER) 31 December 1971 (1971-12-31) figure 1 page 3, line 1 - line 35	1-10

A	FR 1 378 232 A (MINGUEZ) 22 February 1965 (1965-02-22) figure 1 abstract	1-10

A	US 4 009 695 A (ULE LOUIS A) 1 March 1977 (1977-03-01) figure 1 abstract	1,23,25, 26,28

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

Box III   TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

Engine using wheels rotating inside the engine case, these wheels contain cylinders with its pistons which have the abilities of linear movements inside each cylinder, all wheels fixed on the same straight main crank shaft, each wheel conducted separately with is seals, valves, spark plug and exhaust pipe. The cylinders placed in center-side of each wheel as the required discipline for each engine design, each contains piston with design relevant flexible elastic push-arm, the chambe for each cylinder is in the circumference zone of wheel. The air-fuel mix charged in pressured situation from outside by the required accessories, by a valve away from firing portion, the wheel circumference quarded by anti gas seal in three portion or more fixed in the case to separate mod of the chamber mix zone (stoke situations) during the work of the engine.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
FR 2252764	A	20-06-1975	NONE		
FR 2229274	A	06-12-1974	NONE		
US 4127096	A	28-11-1978	US 3967599 A DE 2531564 A JP 51033208 A		06-07-1976 05-02-1976 22-03-1976
AU 5980286	A	15-01-1987	AU 610054 B		16-05-1991
NL 7310257	A	28-01-1975	NONE		
FR 2086778	A	31-12-1971	NONE		
FR 1378232	A	22-02-1965	NONE		
US 4009695	A	01-03-1977	NONE		

(54) **Title:** SHIRWO SYSTEM (A NEW INTERNAL COMBUSTION POWER SYSTEM)

(57) **Abstract**

Engine using wheels rotating inside the engine case, these wheels contain cylinder with its pistons which have the abilities of linear movements inside each cylinder, all wheels fixed on the same straight main crank shaft, each wheel conducted separately with its seals, valves, spark plug and exhaust pipe. The cylinder placed in center–side of each wheel as the required discipline for each engine design, each contains piston with design relevant flexible elastic push–arm, the chamber for each cylinder is in the circumference zone of wheel. The air–fuel mix charged in pressured situation from outside by the required accessories, by a valve away from firing portion, the wheel circumference guarded by anti–gas seal in three portions or more fixed in the case to separate mod of the chamber mix zone (stoke situations) during the work of the engine.

-- SHIRWO   SYSTEM --

(A NEW INTERNAL COMBUSTION POWER SYSTEM)

AN ATTENDANCE FOR A PATENT:

INTRODUCTION:

This is a research for a new system's design in combustion engine with a better fuel's energy utility by using potential powers computerized in this system to improve and maximize the fuel energy in producing torque power in a small automotive power engine with economical industry ways of manufacturing and more advanced practical ways of controlling the engine activities for various engine outputs fuel consumption.

It was ten years old dream of the inventor to design a powerful internal combustion engine ,flexible in work and more harmonic in performance that required by Man to be the much close transportation engine to him as a living machine.

A new environment-friendly generation of a very advanced combustion engine may appear ,since it depends on those technique principals used in atmosphere flying and beyond it i.e. spaceship in flying free from earth gravity ;all inside this engine discipline . A deverse scientific researches need for developing it in order to reach the best conclusions for various proposals implying this system for different kinds of work and the best economical commercial productions for each .

This principal contains extensive principles, it needs to be developed scientifically, mathematically in specific industrial laboratories to conclude the various designs according to the production standard requires.

It's being more than hundred years since that invention of Petrol internal combustion machine had appeared, still used until now to supply automotive power.

The fast progress in the world , the financial developments , the economical problems and the increase of pollutant affection on earth , make it necessary to improve a new automotive transportation engine with a new system to convince the consumer requirements in the main time convince the aim of environmentalist organizations by the good specifications and performance of a new system which could apply promoting solutions to future environmental problems with the best economical fuel consumption .

It's time to reconsider the way of using the potential energy of Petrol fuel in producing automotive energy for the light transportation equipment, in away to improve the principal of fuel combustion to be in its maximum useful potential advantage in producing torque power inside a small simple economic machine.

Using the facilities of advanced scientific techniques and the recent progress of computer control systems in most industries.

Wishing to be a very useful system to solve future problems and to be invested by all the world for peace purposes and human progress with a better use of Petrol-God's generous gift to Man ,the best valuable powerful cheap material ; by a best way of utilizing automotive energy with economical consumption hoping to be used at 21st century

This system :

This a brief configuration contains: description ,major changes ,design principal (back ground), compositions & accessories, engine performance & analysis of potential ways of producing torque powers, useful industrial & commercial characters, details ,it's various design proposals ,drawings(Figs) contents, drawings details and then Claims & abstract.
TOTAL OF 30 PAGES OF CONFIGURATION plus 25 DRWANGS

.... **DESCRIPTION** ....

SHIRWO:(S-owner-ref or Spherical, HYDRAULIC ,INTENSITY, ROTARY ,WHEEL ,OPERATING)
SYSTEM : A SPECIAL MECHANICAL DISCIPLINE FOR INTERNAL COMBUSTION ENGINE.

A new compacted power engine designed to use the fuel chemical energy in specific relations with the additional natural forces using new techniques of many dynamic principles using mechanical metal machine to produce better torque output power.
A mechanical engine (a new combustion system design) produces torque power from Hydrocarbon combustion energy using any types of gasoline fuel or could use (jet kerosene) or (gas fuel) in this principal ; to produce powers from expanding volume i.e. pressure of gases that result from fuel fast burning (combustion emission gases) in closet chambers, and transfers these powers to torque movement,using advanced ways working in one connected system that applies additional potential powers to fuel energy and provides pioneer industrial and commercial characters in compacted power engines.
A practical engineering design that composes types of recent combustion principles which produce torque power from fuel : piston ,rotary and turbine in one compacted composite system engine unit.
This system with its mechanical design would use a new way of circular distribution for pistons locations in engine case with the advantages of this locations in work that apply more potential powers to fuel (additionally)on engine output with other good advantages
This mechanical system has designed in away to use energy of the **chemical's** fuel combustion in engine,added to it in-visible powers after the instance of fuel combustion ; many powers would appear due to this design and will be utilized to act positively on the same target i.e. magnifying fuel combustion output, maximizing output of the engine.
By utilizing the special advantages of gas characters in closet chambers (combustion's gases in chambers at specific places) then computerize many energies in the right action as positively on power torque direction to increase fuel output in engine (for said fuel) with many good advantages for this automotive engine, especially in fuel consumption .

A new design principal of internal combustion power engine using chemical fuel energy in high efficiency by adding to it potential physical powers that agitate the nature principle due to dynamic effect on elements in this engine and on gases those appear due to the new mechanical design which will increase output and reduce the said fuel consumption, i.e.a new way of magnifying the fuel chemical combustion energy by using the advantages of dynamic nature physical principles.

2

THE PRINCIPAL OF THIS SYSTEM DESIGN (Back Ground):

The conventional pistons combustion engines depend on a set of piston cylinders fixed in engine case(chassis) using reciprocated push-arm between pistons and a zec-zak crank shaft connected with them in determined angles by a friction minimizes pads, transferring torque depending only on the direct contact principle of dynamic .

This mechanical design are seated up in a discipline to use the direct contact dynamic and also by deliberates and **agitates** some physical energies, to appear then producing potential positive influenced powers that all will act in the same way with fuel i.e. in applying powers on engine crank.

the positive summation reaction (resultant) of those energies will devolve to act positively on output after fuel combustion occurred inside chamber(s),which could be driven to produce more output power on the crank; as the system extra physical powers.

This positive resultant power reaction due to the system design (at typical mod) of:
1. Nature's elastic character of element(metal spring or hydraulic device resistant).
2. Nature's Aerodynamic of gases by the potential energy of exhausted gases power.
3. Nature's physical principle of the centrifugal potential power(appears at high speed)

These nature energies appear due to movement effect on elements (gases and piston mass) which let new potential energies occur , instantaneously after the occuration of fuel combustion in chamber of (said)fuel then maximizing output in this system. The positively reaction of any of these power will be in relation to engine design and speed situations .

The mechanical design of this system would keep a minimum energy(combustion power) loss inside due to it's simple machinery (recent systems loss rate 20-40 % due to their, machinery parts ,friction,heat...etc) which affects on the power-weight relation ,thus this system would assume :

Almost total potential fuel combustion's energy will transfer to torque power . Although the speed could be invested in this design **in reducing** the fuel consumption automatically.

The scientific research concludes to a new spark internal combustion system that is: **A system of any piston (or group) can work independently maintaining smooth performance without disturbs engine efficiency , a system utilizing the potential physical powers in output and can counter the fuel consumption in increasing speed**

The main target (by the inventor) of this system was in setting separate power units in one engine and the ability of changing any units performance output automatically by easy management from out side ; in a small compacted engine .

This system will be perform as a multi purpose engine depends on types of work An engine of economical production by deducting many industrial requirements , reducing the lines of production these mean reducing the costs .

The design will provide many good industrial techniques briefly like:
A peter engine performance ,less fuel consumption ,a perfect with flexible(or automatic) output, a built-in pollutant treatment, a devisable design proposals with less industrial requires, economical productions and easy , long duration maintenance and other things.

3

MAJOR CHANGES (IN TECHNIQUES) :

The techniques in this principals totally differ from those recent systems . known as: **Otto , Diesel , Wankle** or those with modified DOHC,SOHC or even **Turbine system** The global change is in the basic design from those internal combustion engine:it is by using wheel(s) inside engine ;containing piston's cylinders in a discipline that could transfer fuel energy with additional potential energies into torque power in the engine beside other major changes which would apply good industrial advantages .
A system of various power stroke,one or two or three or more piston power strokes as ..required(at the same,piston- bearing zone part-on torque crank);at one crank rotation!.
A system using engine with rotating wheel(s) fixed on straight crank shaft!.
A system of independent piston performance in related to crank shaft or to other pistons!.
A flexible(elastic characters)piston push-arm to transfer potential energy to torque power!
A system using charged (pressured) air-fuel mixture(beyond turbo); to a spark engine! .
A system combining piston&rotary; technique performance in one compacted engine!.
A system of different cylinder and other type of valves in the discipline and places !
A system that agitates to utilize the physical energies of the nature's principals powers !
A system using dynamic power of exhausted gases to act as (semi) turbine output power!.
A system that could reverse,the high fuel consumption ;due to speed increase!
A system with less transferred combustion energy Loss to torque by its machinery !
A system leads to set an automatic performance output units performance in one engine!
A better fuel combusting in all fuel's situations using elastic flexible space chambers! .
A system could be used in horizontal or vertical crank(torque shaft) ;direction !
A system treating pollutant in practical ways with a built-in techniques engine! .
A system of good output ,slow or high speed safe performance in one engine unit !
A system cheap less industrial requires and simple maintenance,!.
This configuration is theoretically expected , it depends on scientific principles and could be developed and practically concluded with other new extensive characters could be reached by assistance of specialized automotive laboratories using the available advanced techniques of :the metal alloys , dynamic ,liquid hydraulic data and information available for composition's elements and dimensions with the required industrial specifications and assistance of computer processing in design , even in managing control of engine activities and power output performance for this system.
This new system with it's design principal and its principles included changes in the way of transferring the fuel energy to torque power, maximizing this energy than before using simple applications depending on different equations from those used in recent internal combustion systems , this system will apply extra value for fuel energy.
The fundamental principal for this system and it's principles; could be developed for use now as : **a new advanced system** , whenever the advanced facilities available ,or a part(s) of its principles could be used now **(i.e.partially used**) in order not to interrupt or influence on those recent automotive industries in order to prevent any sudden commercial impact in their productions.
However using any of these principles should be referred to this **(research)** .

MANY SPECIFIC CHARACTERS WOULD BE INDICATED IN THIS CONFIGURATION.

THE MECHANICAL COMPOSITIONS & ACCESSORIES DISCIPLINE
Compositions as per the typical drawings of the three - of 2-pistons wheel units engine

1. Out side Case(the engine body chassis) a metal cylindrical or octagonal shape(as in the drawings) with a diameter of 330-380 mm in horizontal-position on crank and app.length(as drawing)of 550-650mm with a large cylinder cavity of 301mm. Contains trenches for seals, tunnels for oil,water and places for valves with special exhaust openings.The industrial requirement may divide it into two parts upper and lower or more.(Det-2 Fig: 2/25&, 3/25,4/25)
    The manufacturing of engine case by coasted steel alloy with trench's and tunnels.

2. The Crank(as crank shaft)a torque output shaft is a straight black solid steel iron . placed on the horizontal center line of the engine along the Case length and extended more, its diameter 25mm-50mm. fixed at the connecting points with the Case by ball bearings, which allow it to rotate only on its center line.It may contain oil tunnel in the center line contains holes for linking oil feeding to rotating   parts. Its surface geared(grooved) to interlocked with the rotating parts to move together . (Det-6 Fig: 2/25& 4/25)

3. Power wheel units (Energy production units) metal wheels (3 in this drawing) each one is a solid strong light alloy wheel ,a diameter of 300mm and a width of 120 mm with smooth surface(s) strengthen by (anti smashed)alloy ,contains (here)two cylindrical hollow(cavity)with opening placed in opposite directions with smooth internal surfaces Bore.The pistons placed in each one. Its diameter (here) 80mm and length of 120-180mm depending on the industrial requirement data. each cavity base with two small oil stores(sumps) one which receives oil by tunnel linked with main supply tunnel(canal) in crank for intake lubrication oil to feed piston arm
    Other store of out let oil flow from piston arm to be disposal by other tunnel into wheel side. An opening between these two sumps in a way maintains the feeding store in a full situation always. The central grooved opening of the wheels to interlock the connection with Crank (torque output shaft).There are two washer around the crank on the two sides of each wheel for oil lock. There are two trenches in outer circular circumference face of the wheel for fixing a pair of side circular gas-oil wheel seals-sliders .
    The number of these wheels depending on the design and output ability of the engine. The direction of the longitudinal center line of any piston's cylinder in a wheel differs from the near cylinder of other wheel in a known angle that could be found from dividing 360*by the numbers of total cylinders in a typical engine.
    The crank may be trenched according to the wheel numbers for easy assembling that starts with cooling pad and wheels in required angles and ball bearings particularly i.e. all rotating parts to be geared together on the crank, by pressing exactly at its designed places before fixing the crank in its Case position.
    (Det -3 ,Fig -2 /25 & 5/20)
    The manufacturing of power wheels units could be done by costing alloys with trenches ,setting drilling, wielding tunnels ,modified circumference and grinding cylinder bores as these would be the main standard mass production units in any engine design industry line for each proposal.

4. The pistons: each one is of solid metal alloy high resistance light disk, fixed inside the cylinder with 20-35 mm thickness nearly the same cylinder Bore diameter. It contains in grooves the circular seals for gas and oil . There are suitable two middle inside tunnels for lubrication oil inlet and outlet that linked with the build-in pump at push-arm device top end .There are other smaller radial tunnels linked separately with each of these two middle tunnel and piston circular edge to cool piston and to distribute oil to piston wall with Bore surface. A special lubricating seal or two in the oil gap on piston wall to uniform the lubrication of piston circumference with cylinder bore. i.e.between piston and cylinder for good slipping movement. Minimizing friction and heat while piston in movement. The piston is connected by wash- bolts with its solid bearing base plate that capping the flexible push-arm. There is a solid steel ring at the top of cylinder Bore fixed in a groove to lock the piston in the cylinder at movement .
A suitable curved piston top capping face required(Det 7- Fig 4/25 ,8/25&)
The manufacturing of piston by costing alloy with tunnel ,grooves and seals..etc ,

5. The flexible piston push-arm of metal a pair of stainless steel pipes slipping inside each other(or a couple) fixed vertically on cylinder base inside it. A metal mechanical spring(straight or inclined)arounds or built-in with the push-arm,used . This method to maintain vertical piston movement. A push-arm design to work as resistance of elastic character with the required calculation for each design proposal . A hydraulic device(like the shock absorber) working as a flexible elastic resistance system with particular reaction(capacity) depend on type of engine could be connected the piston to the wheel at cylinder base in vertical movement ability only(same that spring or device which used in automatic weapons to re-fill,artillery guns etc).(Det- 8, Fig 4/25, 8/25 & 11/25)

6. The piston lubrication pump, is made from pair of sliding pipes each of two small stainless steel pipes slide in each other contain tunnel inside it for oil ,consist one way oil valve (check valve)for each inlet; in opposite direction (a valve ,using solid small ball locked in a small chamber ,an opening with a diameter less than the ball's half spherical shape and other opening of many small hole to let the oil flow at one direction for each position of piston movements) to act as ordinary shaft pump due piston movements(with push-arm) .
A pump of two opposite direction flow pipe shaft as in the drawing to work also as push-arm device.. for example...(Det- 10 , Fig 4/25 &8/25).

7. The cooling & lubrication pads :each one of light alloy with radian trenches,starting from central sump to the edges attached the wheel side wall ,working almost same as a centrifugal circular pump. A diameter a bout the same of wheels ,and an opening of oil feeding from central Crank tunnel to bring oil from the crank to distribute it on wheel walls, cooling them then disposed to the circumference edge then to Case inside wall tunnel. It contains low(or high)zones at the modified smooth edge in certain places against each chamber for slipping the mechanism bar timing system of the air and air-fuel mixture valves, for each wheel when rotating with the crank .This is the way of computerizing the timing of valve opening against particular chamber, in the right time. It is a simple,easy, brief, oil moisturized and a perfect independent mechanism way crossing the Case for each wheel unit . (Det- 17, Fig 3/25 &7/25).

8. The seal mass(s)anti-gases fixed in Case: each of metal alloy (or hard anti-heat plastic combination) according to its work which is the anti-gas seal attached the wheel wide circumference face. It could be any size but at the same width of each wheel's circumference face.It is attached with the two circular wheel slid-seals(the Case part)at the sides, A right depth fixed from outside on the case by special looked washer. It could be adjustable ;if using adjustable seals(in attached) with the face of wheel by a mechanical controller spring regulator or(automatic thermal regulator). The principle is on connecting between the two circular seals Case parts of each wheel and a well attached to the wheel circumference to supply a locked situation for chamber to prevent gases from penetration.

For a metal alloy it could be design in a special way using linear metal seals.fixed in the base of the mass, with various technique methods of oil feeding using the advantage of one way rotation of wheels.

A relation with rotating direction and existing of special small inclined trenches on wheel surface in the right place(or on attached mass unite) with automatic opening for oil inlet and outlet holes. This could apply with a timing pins in the rotating parts .Using the advantage of one way rotation monitoring oil discharge from Case (or wheel phase) starting before entrance of seal and disposed while wheel rotates at a duration enough to lubricate attached zone particularly.

This would be guarded with sprigged solid balls in specific place each mass with a timing system controlled by one side pad edge of each wheel,(or the wheel it self)..

Another way by applying holes in the circular gas seal system ,the special timing controlled opening system depends on one way rotation (i.e.if using circular seal with blade rings in the Case-wheel interlocked parts) at seals. there are special holes on each blade ring that opened across as one hole when connect (blades)all in one fixed point(s) to set across opening hole for oil feeder from Case at required place.The direction of rotation and trenches in a part zone of wheel surface will collect the lubrication drops to the outlet hole(automatic opened) before gases attend reaching the seal mass from far chamber and before even the chamber reaches the seal position maintaining surface in a good slipper.However the gases pressure direction may be to dispose the oil in the right time .The number of these seal 3to4 and the radian distance between each one is less than the net radian distance between a wheel chambers as the distance of specified attached surface.

The diverse research of lubrication technique various depend on expert laboratory.

The working principle of these seal in their circular positions around the wheel are to maintain and to transport the locked situation chamber(s) while rotation of each wheel .

These seal masses in three type of work .No,1 for one way anti-gas of air-fuel mixture ;when start charging it .and the place directly after pure-air valve.

No, 2 for two sides anti-gas , a side for the charging air-fuel mixture although other side for gases of chamber after combustion, at place before the power stroke.

No,3 for one way anti-gas of the combustion gases at place before exhaust opening

The size of any seal mass could be design in order to allow a piston's maintenance from its Case opening without open the engine Case regarding the simplicity of assembling the piston and push-arm .

(Det- 19 Fig 4/25 & 18/25)

7

9. The circular seal (wheel-case oil seals-slider) on the two sides edge of each wheel circumference are (in various technique).A suggestion of suitable two or three stainless steel blade rings mass fixed in special grooves in the wheel (or) with one set parts in Case and wheel to be interlock together when fixing the parts of the engine ,using separated pair pieces fixed in Case, other ring fixed on operating wheel . The seals components would formed together a tithing and a sliding device to protect the pads from any penetration of combustion gases(and maintaining the required locked chamber for air-fuel mixture). They could be lubricate with special holes in the right place where no longer pressure on it, (i.e. end of exhaust opening)or using a self-lube.This depends on the expert industries laboratory (Det- 26 , Fig 2/25 &3/25).

10. The ordinary oil pump which fixed in the front of the engine (or else). Connected with the crank to transfer oil from lower store tank -that oil flow coming from Case ended; to the upper oil tank which discharges the intake of the main tunnel of the central crank with its winging (impeller) parts .It is in a shape that could direct the flow of oil sucking by tunnel's inlet holes in crank which suck it when rotates to discharge it to pads or pistons in each wheel by its holes depending on the Central-fugal principle for each part.These holes in the crank could be in a special designed in their opening diameter depending on the distance each from oil main tank (Dec24 ,28 Fig 2A/20) The trenches in each pads will be filled with oil,feeding from Crank holes flowing due to engine crank rotation directed out from centers by centrifugal energy due to rotation.The grooves in a way contacting the power wheel unit's two side walls, for cooling as to reduce adiabatic. This is the enthalpy heat system of each power wheel unit . The oil flow would exchange the heat of cylinders after fuel combustion . The pistons get their lubrication oil with the same principle, from a small tank (sump)in the base of each cylinder as in take store that would be refilled always(by arrange an opening in its top to the out let store with excess length of lube intake tunnel) The demand of lubrication oil fore each piston would be supplied by its movement. The piston will take sufficient lubrication oil by its lubrication pump fixed in its push-arm that suck oil with the latter movement supplying the piston needs then due to flowing will directed out side by out flow tunnel to outlet sump then far from wheel center to wheel side wall and drop it in pad trenches due to rotation by the same principle (Centrifugal principle)(Det-:10,11,15,17, 28 Fig:2/25& 3/25)

11. The valves of air-fuel mixture and pure-air are of same shapes ,each one is in a separate short pipe device contains valves of a triangular wide back opposite to the air pressure supply direction moving in a same triangular or curved shape opening It is guarded with spring . The place is in Case wall far away from firing zone to be directed at central of the wheel circumference surface and to be opened at the right time against chambers .They are controlled by rotation of cooling pad by a side of each power wheel, with a simple mechanical rod system connected within the pad modified edge. There is a small smooth roller ended at rod that (which is oil saturated) attaching the pad edge for timing the opening by the main of lower(or upper) zone on the pad edge using this mechanism to transport the movement to valves.(Det- 20 , 21, 22. Fig 4/25 y& 7/25).

The air-fuel mixture valve is to supply and charging the air-fuel mix to chamber

The pure-air valve is to supply the fast(pressured) to chamber for cooling and scavenging the after burn gases in chamber by pure air.

The two valves in each wheel charged consecutively with pressured air by one device to their two pipes from the same resource(pressured air cylinder or centrifugal turbine) which connected with engine rotation.

The principle of distributing the air between the two pipes for chambers i.e.the two supply system for all wheels consecutively; depend on distribution at different angles(i.e.different timing), maintaining the required pressure for both air-fuel mixture and pure air (scavenging on chamber) at various speeds. The controlling requirement could be by using out let opening regulator of pressure release of main air supply(i.e a reducing of that opening in higher speed mean more pressure to engine). Using a device before air enter the two pipes. The fuel would be splash at required mix or various rate(as required) to charge the pressured air with fuel then to supply the chambers before power firing stroke . This done by a simple device with needle valve(s) or sub carburetor or with additional mechanical or electrical computerized system as indirect injection (pre mixing in the pipes or sub-chamber for each .

12. The ball bearing fixed in engine Case for holding Crank by connect it with Case from two sides   (Det- 27 Fig 2/25&3/25)

13. Water pump as known in the front side of engine(or out of engine) with its outer radiator pipes, with Case water cooling system tunnels(canals) to cool returning hot oil and all Case.(Det-23 Fig 2/25,3/25) if required or using air cooling system.

14. The exhaust opening in Case starting a small with graded increasing in the direction of rotation in a special aerodynamic design in order to make the escape gases at exhaust stroke took penetration position rapidly in a way produces a potential power reaction on wheel act on the same direction of rotation.

The principle used is the reverse of flying principle which used the fast air produced by plane fan to produce fast air on airplane to fly . in this design an assumption of fixed fan(the exhaust special opening) will be under fast air reaction (the combustion resultant gases , under pressure) the wheel free to move (as plane) i.e.wheel will be under reaction of an excess potential power to rotate it,assuming Case moved in related to wheel put really the wheel moves,in reversing situation.This opening connected strongly with the exhaust pipe for each wheel then connected with the main exhaust pipe, and its angle depend on calculations of various data .(Det- 30 Fig 4/25).

15. Ignition distribution as known, put the number of contact points is twice the number of power wheel units(depends on cylinder Nos. i.e. a triple for three cylinders in a wheel)with the same distribution angle for the whole cylinder(pistons)distribution in engine .Every group of contact points for each wheel connected together by one cable and one spark plug for each power wheel unit .The rotating conductor could be (here) two opposite points contact every time . (Det- 28 Fig 3/25)

The ignition distribution connected with the crank in a suitable place as rotates by the crank shaft .

For engine of one large wheel with many pistons(cylinders),an ordinary one point contacted , same angle distribution ,using one cable i.e. ignition could used easily.

16.   **The accessories devices :**

A cylinder for compressed air with compressor pump, this is working with the engine rotation by a belt. A centrifugal turbine fan directly connected with Crank could used to supply the pressured air. The charging air supplying both air-fuel mix and pure air for the chambers. A mechanical / electrical controlling device of air pressure connected with the accelerator pedal of the driver(a better performance than ordinary turbo charger although a better modified turbo charger could be used that depending on turbine and pre-heated by exhaust gases speed and heat)

The fuel spray injection instrument device to splash it in compressed air using the simple natural spray principle of a liquid (i.e. catamization) depending on volatile of opening and specific density. This is the indirect injection way of charging the air while still in its way to chambers , maintaining idle (slow engine workability) by electric needle valves works with ignition by electric device.This suit for any kinds of fuel, a mechanically or electrically device system,can be supplied as one unit for all engine chamber requirements since its one pressure control accelerator .

A separate pipe opening regulator for each wheel unit fuel valves requirement with a use of controlling system for automatic engine.

(or using independent fuel injection on supplying pipe near each chamber valve)

(or using direct chamber fuel injection with its device for each wheel.fixed in Case) .

Air for charging mixture would be pre-heated using device with electrical heater or utilizing emission heat by attached to exhaust gases pipes

Fuel pipes and fuel pump .

Charging (compressed) air pipes with required pressure resistance.

(Fig 22/25 &23/25)

17.   The compositions's fixing set up (assembling method) is starting with the crank carrying all the wheels and pads to be pressed together as the required angles , places for parts and fixing the ball-bearings on crank then fix all on the lower part of Case after fixing required the circular seals on the wheels and trinket in groove on two parts of Case then other accessories.

N/B

1. Since this is a new system , I tried to use a simple English language ,with some data of conventional systems components names, however these names (as specified) are not necessary the standard names of parts in this system .

These names may be changed in the development process according to the final proposals and the their relevant industrial standard names , later ..

2. All the discussions as for the enclosure drawings which are the references that declare all the compositions typically using Autocad computer drawings.

(Drawings detail are the liable references).

3. Enclosure the typical drawings set of 25(twenty five) pieces

USEFUL INDUSTRIAL AND COMMERCIAL CHARACTERS

1.   A simple - easy to manufacture and less components parts .
2.   High output related to size and cost, a system contains pistons with rotary operating using exhaust gases aerodynamic potential power advantage
3.   Using a new principle in charging(i.e. compressed air-fuel) the air-fuel mixture to the chamber from out side with any pressure needed for the required performance, not as the old principles which suck the air-fuel mixture to the chamber and compact it to be in pressured situation by the same piston . This means using of a jet technique in charging fuel ,in this design which will give high performance as fast better fuel burning as fast rotation engine needs and in relation-with other specifications; it would be very practical system .
4.   The pistons in this engine connected with a flexible push-arm (flexible shaft bar) working as elastic resistance using various resistance,depending on the power data. occur in the chambers at firing stroke,(types depending on fuel and output design). This character will apply good specifications, one of them is in reducing the sudden impact and will uniform stress of high power if occur on piston(s), in away that the arm resistance will transfer stresses on pistons uniformly on crank i.e.making the engine more smooth, reducing vibration., The elastic flexible piston depressing will allow a good flame propagation (as automatically controlled of combustion chamber space) ,and the same reason to prevent detonation in chamber,
The other advantage is to store some of it (the stress) toget use of it later (it will charge the piston elastic resistance)to use it in the same purpose i.e. transfers it later to positive reaction .The design will use the stand-still locket gases accrued due to fuel combustion against the piston(in chamber); in away using the stored energy again to use it in the same direction(this happen fast,increase in high speed). The very next situation where the pressured gases (as stored energy) start to penetrate and release free out (in exhaust stork), from the exhaust modified opening ; the charged resistance add an extra power on penetrating gases as it starts returning to its first stag ; a potential aerodynamic power exist by reversing this power with the elastic assistance of modified exhaust opening, (counter the theory of fly principle as aerodynamic reaction .
The aerodynamic power of the penetration of the chamber's pressured gases from graded specific opening of exhaust ; will act against the wheel.
Those analysis conclusions could be confirmed in specialized industrial laboratory using physics, mathematics principles.
These potential powers would act as positive summation resultant reacting on piston causing more power added to combustion gases pressure in chamber to react on piston as additional power effect on wheel rotation .
The centrifugal natural power reacts on pistons(cup) as hunged in the circular zone of rotating wheel ; will produce other reaction in high speed .
The potential invisible power could be used with other analysis to minimize the fuel consumption by reaching a special situation between high rotation speed and depressing of piston in combustion instance ,using the required resistance and the relations of speed with dimensions and a computer device analyzing these criteria's   (Fig 18/25).

The natural heat energy advantage(if used) would tight the flexible push-arm of pistons with heat increase especially in using gas ,hydraulic resistance .which (expands!) reducing the elastic movement of pistons(increase the resistance) i.e. reduce the sufficient capacity of charging air-fuel mix for the same output later with continuos working time. **This special design will agitate (at fuel combustion) these physical nature's powers to appear in a situation magnifying the (best)fuel output power in this engine.**

5. The lubrication in large part of it depends on a natural constant principle with a special design that the oil flow will increase with the speed increasing naturally not mechanically (as for conventional engines), it done by a huge centrifugal of the pads by feeding parts inlet oil holes from central tunnel in Crank as with relations to its distance from oil tank at Crank intake portion sucking by rotating those wide parts connected with the Crank magnifying with speed increase , cooling the wheels and lubricating the pistons . This characters will lead to use the far pad as main oil pump by it special trenches ,sucking oil from Crank to supply oil in Case for those seal masses and cooling Case needs in a best way .
The ordinary oil pump could be concealed if the oil tunnels of case terminate at feeding oil tank of the Crank canal .

6. The pistons with its flexibility arms will reduce the reciprocated movement which minimize descending ,(in distance between upper and lower piston's dead point): due to increasing of the engine speed ,due to the design, in a matter (counters to conventional system's principle-at high speed ..!);reduce vibrations of the main engine parts movements while increasing speed .The relation of push-arm depressing speed(time) with a rotation speed of the wheel in increasing engine's speed would lead to the equilibrium situation (as assumption) in very fast speed, it is a criteria of reducing chamber expanding combustion space for fuel at explosion ;descendingly with speed increasing !.
It is the miracle of the circular shape where the centrifugal power exist in engine
This is a very important character and would be utilized for reducing fuel consumption while increasing speed , using computerized advanced accessories .

7. This engine system does not contains those valves that used in the old engine with their timing articulated connecting system,(camshaft, tapping springs ... etc.): that valves with its mechanism however will limit the high speed of the engine,which need complicated frictional slippers and accessories as timings systems, which may fail in high speed,as for the modern engines with more valves number for a piston. Those are not existing in this system i.e. delete their problems ,noises and air smoke related with any of their defect ,although delet their failure which may happen in high speed.

.8. The fuel air mix can be controlled easy in this engine from out side accessories, in two way by controlling the supplying pressure and also by controlling the fuel mixture,or both together,since the system doesn't required the same fuel compression ratio in all wheel chambers or in all its working situations with the independent character of pistons performance and the independent units performance and the flexibility in the engine .Different types of fuel,any gasoline octane with a regulator for fuel splash charger .. Jet gasoline or (gas) can be easy used in this system after reconsider accessories

9. Cooling and cleaning of the chambers by outside pressured air(scavenging) directly after hot gases exhausted (stroke). This will control the heat of piston capping and supply perfect adiabatic efficiency of air (heat loss) system for pistons in addition to the wheels side walls oil cooling (enthalpy) of cylinder bore. The air also will prevent the remain of after burning carbon (soot) and will complete oxidize un-burning fuel and carbon oxide gas(CO) to complete oxidization it directly to (CO_2), same for nitrite oxide(NO) ,this is a very practical way in pollution's built-in engine; treatment,in away to help conserve environment and atmospheric ozone.

10. There is a new way for lubrication of the pistons that only the moving one will be lubricate when it needs to,as each piston has it's own oil pump , and the lubrication system in away that can reduce too much the pollution of air-oil smoke, since no crank case sump bellow the pistons, however no leakage gas affiction on oil sump if this happen.
There would be an air pad(s) under the piston(s) that could use it's advantage in a special piston design to maintain an almost equal pressure in high temperature in the two sides of piston i.e. on it's seals to be utilized ..for longer maintenance period and for output .

11. The distribution of piston(cylinder) angles against the crank C.L.in the engine will not need a balance weight which existing in recent engine, and their metal bearing (begins) pads on crank shaft for stress points lubrications to reduce friction on crank shaft which affected obviously in that system by high speed , those are not required in this engine system .the way of emission gases exhausted with the rotation direction will minimize the stress on seal mass ,helping the good lubrication for seals.

12. This new design in distribution of pistons with a unique way in free movements of piston with the rotation of the main shaft (torque crank shaft), since the principle used here - will not need to distribute the stress for every combustion (piston) unit. as for the other; all working time, like what happen in the old system which all connected with the crank shaft; each one with (special angle) in slipping point guarded with metal bearing pads, thus all the combustion pistons will move consecutively (mutual) equal in side the cylinders due to the rotation of the crank shaft, all the time, and will increase with speed ascending causing much friction, lubrication, heat and vibration ,which affect the engine efficiency. This new design system reduces piston movements(descending) with increasing of speed rotation; due to spring flexibility (elastic) system reducing: the friction, heat. vibrations noise and, even it can reduce the fuel consumption. .Using very advanced controller systems from outside depending on the harmony. hydraulic movement of pistons which will reduce in high speed .

13. The best seen character for this engine is the multi output power which can be changed in various ranges not even depending on the rotation speed of the engine but on the working parts inside the engine (automatically power output) .
Like for example all parts in used supplying100% output of the engine for heavy work in a car engine, or 2/3 or less of parts in used for high speed or 1/3 or less of parts in used for just to keep the engine in Ideal working situation, this could be done in away that even its services(for un-used wheel) ; could be stopped.

This character is very useful: in fuel consumption, in reducing pollution, in long maintenance, this new engine can be produced as engine for every work (multi-purpose)in one equipment (i.e. one car) which can automatically control the output as required, without affecting on un-used parts or make tough vibration . SHIRWO Automatically Need engine will be called Shirw_a_n...(SHIRWAN) system {rotary wheel automatic need }.

The transmission gear complex in this engine would be minimized

14. Since the abilities of stopping some of piston's movements(or all) in this design with the continues rotation of the crank, the engine can be combined with an electric power sub-engine in the same crank in an advanced design with a very practical use (fuel combustion engine and electric power engine in one unit set) depending on the simplicity design and minimum torque loss of this new engine which can charge the electric battery when the combustion engine working , and can use the electric power engine directly instead - if it needs ;at required situations as needs in a crowded city. to reduce the pollution

15. In addition to other characters and proposals which can be obtained in industrial laboratories this machine will fill the gap between the normal pistons combustion engine- and Jet engine using their-all- good characters together in one engine ,it will use the good characters of combustion piston (rotary) engine in economic fuel consumption, slow rotation speed if required, small engine and easy to manufacture and maintenance,, with Jet characters of high power ,high rotation speed if required using the aerodynamic power of exhausted gas with other potential powers ; in an advanced designed and cheap engine unit .

16. This design will open the wide gate for computer participation's in controlling all activities and performance characters using very advanced controller's accessories in this system at near future, inspite of the high speed ability of this engine and its good characters, which will give this engine a great economic influence

A promising generation of combustion system will appear in the near 21st century,to use it in advanced small - Hoover craft- to become cheep transportation's equipment.

The very important character of reducing fuel rapidly (descending) with speed increase as the main way of reducing fuel in increasing high speed in this design.

The analysis system characters leads to use it in high speed that causing less reciprocating piston movement in engine which makes it very qualified engines for flying equipment.

Many advanced research on it will continue ,for an example the Laser ignition may be used in its ignition due to its high speed !.

ENGINE POWER OUTPUT TYPICAL PERFORMANCE
(As for the (drawing)- Fig 19/25)

1. The engine start rotate by a starter motor accessory fixed near gear end, by a starter switch for few seconds.

2. All the inside parts will rotate, the valves start its work due to the automatic system of controlling its gate opening a giants each chamber in power unit wheels feeding the air-fuel mix ,controlled by accelerator of driver pedal and its normal (idle) minimum working feeder ; to the first chamber by opened the valve gate at the same time with the timing duration's of the cooling (lubrication) pads by its connected taping bar. The air fuel mix will enter the first chamber over the piston and the continuing of rotate will take this chamber filled with (compressed) air fuel mix in a place opposite the spark plug.

* (as suction stork in old system) ..here{ fuel charging zone }

3. The chamber will be filled with compressed air fuel mix that maintain in pressured situation since the chamber locked by Case wall and piston and gas mass seals from two sides in circular wheel surfaces back side Case wall.
The position of seal masses on wheel circumference will kep it loket . ‾
When the chamber placed opposite to the spark plug, air- fuel mix instantaneously sparked by ignition timing distributor, and will explode to gases. due to fuel mix fast burning .A production gases which need to expand to their natural large volume, in closet space ;causing high pressure power on surrounded walls and piston which has the flexibility of start moving depressing due to its special spring connector inside the cylinder base, causing stress on the spring in the best typical way , by power stress due to gasses to piston then depressing then charges energy to the spring (elastic)system .

* (firing stroke)..old system ....starting power stroke .
{firing stroke }..in this system,,,,,,,,,,,,,,,start power zone

When the piston stress the spring system, the spring will transfer a part of this stress to the cylinder base (wheel side), causing rotation of the wheel, and the rest of that stress on spring will be stored as charged resistance assist to magnify the rotation power later at beginning of the exhaust graded opening to maximize the aerodynamic reaction on wheel rotation (this is the power duty of spring elastic power system here) .

4. Apart of stress on the cylinder base caused by spring on side of wheel center will push the wheel to rotate depending on this part of reaction of gases pressure in the chamber due to pressured air-fuel mix fast burn ,which will happen in other unit in succession.
* (expansion power stroke-)........................... with enthalpy.   (old system)
{expansion power stroke -1st power zone},,,,.with enthalpy   (Shirwo system)

● ●

Thus the firing stork will finished by burning all the mix then put off; producing potential stored energy (as gases in high pressure)before reaching the last big seal mass which fixed in suitable designed place.. criteria,

5.   Due to the rotation of this (wheel), the chamber will reach the graded exhaust opening i.e.enelarging trench(s) with rotation direction, the already lifted gases which still in high pressure inside the chamber (as the piston in depressed position), new compound stresses in this place due to many potential powers take place.

*(moving up starting - exhaust stroke-end power stroke) loss power............with enthalpy {starting exhaust-return back release gases- 2nd power zone} extra power,,,with enthalpy

6.   The compound stresses that all react positively on wheel rotation are :

1st   in time of gases start to penetrate from the graded exhaust opening - and due to start loosing of gases pressure in chamber the already compressed spring system (elastic system)which has been charged (or partial)by stored energy already produced in chamber before;will start rapidly to return to it's first position(normal situation) pushing the piston upward again, that will push also the remaining gases still not manage to penetrate to escape faster this case will cause potential reactions on the wheel the spring system in getting it'first loosing situation will react in two direction i.e. on cylinder base means on the wheel when gases start escape   ... (spherical reaction) ,

2nd the stored energy of spring(resistance) will attempt to be free causing power on gases (against piston)in chamber and due to circular Case back wall (chamber wall),and the uniform pressure gas physical character of chamber gas pad (still semi- locket chamber)that will counters the reaction ; the potential resultant force will be the positive summation reacts of one direction on piston which is provide another additional power rotating the wheel in the same direction. (spherical react.)

3rd the locked pressured gases which start to penetrate when reach particular wide of exhaust graded opening will discharge fast cause Aerodynamic movement to put the chamber(i.e.cylinder i.e.wheel)in a place that all gases manage to escape faster which cause the wheel to get extra power for rotation by law of fast air principle (as the air plane flying principal put in reveres analysis)

*(upward dead point)..reduce Enthalpy..high degree Entropy with Body cooler only. {release total power}.reduce Enthalpy low degree Entropy with Air scavenging & Body cooler--(end of power zone)
        And so in this place the stress summation will affect on the wheel and this a semi opened position i.e. the effecting of stress on the parts (near by) will be less since the explosion of the air fuel mix already finished before in a chamber alone far from valves.
        Same operation will be happened with the nearest wheel chamber (by angle radian distance) consecutively and the rotation movement will continuo .

7. When the gases manage to escape with the rotate of the wheel. The chamber will reach at the end of the exhaust opening to the pure compressed air valve which opens due to the rotation of the cooling pad tapping timing bar; against the chamber ,permits a fast pure air cleaning (pure air scavenging)the chamber from what left of the gases to exit before the chamber leave the exhaust opening totally due to rotation.This way will cool the chamber by air and would has a great effect in ending the tacking cases due to the remaining carbon optical which may occur after burning the fuel mix and this way of cleaning the chamber by air has a great effect in reducing the pollution of un-oxidized heat gases. After fuel mix burning to treat them while still heat and will minimize the creation of carbon oxide gas element. The pressure of this pureed air will exceed with rotation speed increase. So the chamber will kept always in suitable temperature.

*(move downward dead point- suction stroke) high d. Entropy..lose power due to friction {natural stage - air cooling ,cleaning }..low d. Entropy .. no power lose !.,,

*(move upward dead point-compression stroke)..H.D. Entropy..loss power.
End of power zone (shirwo engine).....lower entropy with air cooling , no power lose.

. **An example of one stroke in each half cycle (here) at each wheel bearing part (wheel zone !) on crankshaft**

8. In increasing speed of this system , the rotation radian velocity of the wheel would become near to equalize with pistons push-arm (resistance) depression's velocity , depending on the elastic resistance(push-arm) data character.
    This means the expanding space of chamber will be reduced (for the said required engine power) by increasing speed ,a mathematics criteria with fuel compression rate :speed, resistance depress ,fuel, dimensions, will conclude to reduce fuel in increasing speed .
    In high speed also , the reaction of the nature's centrifugal power will appear at combustion stroke(power stroke) stage, that acting on piston as its location being in the circumference of a rotating circle with freedom to be pushed out of it(in its moving zone) modifying the piston depressing resistant with potential power but due to gas pad in (locket chamber after combustion happened), although existence of Case circular back wall(chamber back wall) ;that keeping the chamber in radiance move maintaining the same uniform pressure in chamber (due to this design and seal places)this pressure with gas physical character that revoke (reflect) any power reaction on piston(fuel combustion energy and additional excess centrifugal energy) ,will act as a positive resultant on wheel in the direction increasing the rotation power (the new energy is the mass movement of piston   ; Newton law)magnifying fuel combustion energy on engine i.e. reducing the expanding of chamber to the said fuel , means reducing of engine fuel requirement for the said power in increasing speed i.e.a criteria of reducing fuel consumption in increasing speed . (Fig 19 / 25).

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The accessories **performance** which help this engine to work are:
(Fig 21 /25& 22/25)

A.   The compressed air cylinder with its charging motor that get its rotation power from the engine by a belt which keep the air in sufficient pressure guarded by a controller regulate by secretor-bar from driving room which always in closet case when engine stop, electrically, to open on ignition starting with the slowly regulator. The open device to the pipes one for (fuel mix) to fuel spray for whole power wheel units or to separate fuel spray system for each power wheel unit to be electric controlled (computer system). The other pipe device for pure compressed air to the (cleaning, cooling air valve).

B.   The fuel spray system is a mechanical-electrical instrument device with needle valves which use a simple principle of letting the fast air passing on small outlet opening of fuel to create spray in this air as required depending on Specific Density of fuel which maintain in supplied by ordinary fuel pump(mech.or elect.).

C.   The necessary pressured air will increase due to paddle- engine managing system controlling speed of engine's rotation and torque power .
       The other accessories like oil pump and water pump and ignition distributor will rotate with the crank or as for the industrial design.
     The overall work of power wheel units(all) output with a remarkable rotation speed or remarkable pressure for charging fuel will supply monitoring the output power of the engine, that could be modified by various criteria.

CONCLUSION :

       The maximum fuel power output that occur due to a larger piston moment on Crank, than that of recent system, with the effective angle of torque power more than 180 degree(depend on the design).
       After the instance of fuel combustion in this mechanical design system,
       Physical power(s) will happen due to the particular circular distribution places of chambers with the utilization of the physical character advantage of gas (under pressure chamber gases) that occurred after combustion ,although utilize physical powers that happened in other particular places and situations .

1-   Under pressure gases impact on piston, the physical power of elastic character (flexible push-arm),would act on two ways ,a part pressing the wheel to rotate,and other on piston to get back to its top point(upward dead point),due to the resistance of push-arm that already depressed by the piston i.e.chamber's combustion gases . It is gas physical character in a locked space, which would reveres(reflect) any force as elastic resistance to an opposite reaction which will be back again on piston. Since the back side of chamber was the case wall (internal circumference of circular wheel cavity),which is the only sway moving smooth level with (constant fixed axes), chamber still in locket situation by seals Job; while the wheel rotates means keeping locket chamber in fuel firing zone ,
       This is the appearance of hydraulic (spherical) reactions of chamber gases.
       There will be many advantages in utilizing this chamber(gas pad) hydraulic character in this mechanical system to invest all powers happen inside this system positively on engine Crank .

2-   A losing of pressure due to gases penetration when gases start to penetrate due wheel rotate reach the exhaust opening , will agitate the last static elastic physical power on elastic piston push-arm (after first depressing) attending to return back rapidly to its normal position on two direction (sides) of reaction ,meaning on wheel also to act with addition power for rotation .

3-   After the instance with continue of that powers effect . A new physical power happen due to the way of exhaust opening's design that allow the under- pressure gases to extending partially then totally penetrating in away to get their fast best position of escaping from chamber. With the advantage of existing access power from the piston push-arm resistance being under press that attend to return to its normal(first) position. Physical power which is the Aerodynamic that forces the chamber to be at the right position (portion) when gas escape which will cause additional rotating power on the cylinder i.e. wheel to rotate depending on its place and on the exhaust opening place in this design .By the mean of using the same principal analysis mentioned ,that produces aerodynamic power by using the air speed principle(a flying principle put in a reverse way of reaction analysis)

4-   In increasing of engine speed (i.e.rotation speed)a new physical power will appear, instantaneously at the time of fuel combustion .

The piston mass (cup) will be under the force of the physical Centrifugal principle due to its location in circular wheel and its mass-weight(even the mass of chamber gases), this means adding more potential power to the push-arm resistant .That will act on piston against fuel combustion power in chamber .This reaction which transpires to pressured gases which are in a locked space in the chamber, but with the advantage of gases physical character being under pressure (after fuel combustion).. The gas (referred to pressured gas character in a closet space) will reverse(reflect)this power to be opposite to piston face(i.e.same depressing direction) adding additional power i.e. additional power on wheel. That mains the said fuel demand for this situation of engine speed; could be reduced rapidly while increasing speed .(Fig 18/25).

This with other criteria concerning the speed of push-arm depressing formula against the combustion force in a relation to wheel rotation speed which may reach theoretically equilibrium situation in very high speed , thus reducing the reciprocated movement of pistons while increasing engine speed .

That depends on type of fuel(after burning gases compression ratio) and kind of the resistance used with a relation to centrifugal effect on that piston cap ,all analysis concluded with the out put and speed.

A mathematics conclusions for various design proposals reducing fuel consumption in increasing the speed could be reached .Using the advanced conclusion of beyond earth flying principal i.e. space technique of how to allow a space-ship to free from Earth gravity intensity zone by using the speed and centrifugal principle , this system uses this principle inside engine in a small sample but will reverse(counter) this principal ,by reversing its force. The piston to be assumed (fixed) space-ship and the wheel as (Earth) while increasing its speed It is free to rotate (more) , and the re-product of gases under-pressure(due to fuel combustion)in chamber acting instantaneously as more power of gravity(of Earth) ,the reaction will reverse here to act positively again on the wheel!.

An advanced computerized controlling system using the conclusion of that calculations for :a piston weight, a wheel diameter, type of piston push-arm resistance, fuel output ,kind of equipment and speed ; to set a controlling system for reducing the fuel by connecting it with the air-fuel charging accessories devices to control fuel as it required then reducing the consumption in increasing speed. .

This is the way of reducing the fuel consumption while increasing speed !.

IN GLOSSARY (philosophy of this technique) :

This system is utilizing the theory which used in charging water or any liquid by principal of a ""Centrifugal Pump "" rotated by power supplied from other automotive power. (Fig 18/25)

Using the same theory for mechanical design but in a counter way of reactions .

Since the liquid used in place here is that charged with power charged liquid(easy chemical energy analyze)that is fuel spray from Petrol .Which is been used in a discipline that could produce energy force inside this system then making this energy act in a way (i.e. reverse direction on that centrifugal pump system) to make it rotate as automotive power engine, while using the same principle of reaction which is centrifugal(high speed reaction on a mass moving in a circular zone) to utilize this character on pistons-mass(and assumed expanded gas mass) as for their particular circular-zone places in this system for producing torque power then could used in reducing the fuel needs for said speeds (that can be seen in high speed)while increasing speed !.

The performance of the engine depends on many constant assumptions and the proposed observations of its work here without any mathematics figures since those information depend on the industrial specifications, laboratories calculations, kinds of allays ,types of equipment, the capacity of output, fuel and accessories data.

For that reason the definitions are theoretically the principal of performance and could be practically proposed after monitoring the data in specialized industrial laboratories in order to reach the most economic design for each case and proposal.

Note:

Mathematics analyses might be done in specialized industrial laboratory at development process later using the recent requirement data available for proposals

●   ●

SPECIFIC PROPOSALS:

1. Light solid alloy for power wheel unit might be reinforced by hard solid steel in torque stress places (i.e. the middle panel of wheel , crank trunk hole between the cylinders, cylinder bases and wheel circumference as one alloy).

2. Light solid alloys for piston's disk as required.

3. The push-arm resistance capacity for piston must depend on type of: engine output ,speed of acceleration , working out put .,type of design , dimensions ..etc.
    The temperature resistance flexible metal spring system (i.e. that used in weapon industries as. for automatic artillery gun refill spring) or:hydraulic closed system (gas,oil) with heat resistance seals may all used for piston elastic push-arm .

4. For main gas seal mass: a self-lubricated Graphite alloy or hard metal alloy with special lubrication system in the engine case using the advantage of one direction wheel rotation with special trenches and holes, or advanced plastic solid combined material with anti-heat character; the type ,shapes and sizes might be varied from different industrial resources ; for minimum sufficient contact.
    Three types of seal mass ,one for anti normal air ,one for anti air-fuel mixture one for anti- hot gases after combustion occurred before exhaust penetration.
    The same principle for all ,or use couple of seals for two way efficiency i.e .opposite locket reaction in one seal mass unit.
    Wankle seal could be used in each seal mass unit i.e. not in rotary part here but in the case with more efficiency ,workability since it used in fixed place (fixed axes) i.e. maintaining a fixed axial position for the wheel surface contact here.

5. The big circular seals & wheel with Case sliding :are of three or more stainless steel ring bladder inter lock gathered as a slide bearing ring device ..or couple as industrial required .or special wheel's edges with sharp design inter look with engine Case .;with a technique for anti-oil-gas penetration when combustion happen depend on design proposals (Fig 2/25 &3/25) .

6. Oil, gas, rings seals in pistons as specified metals for this work .

7. Lubrication pads light aluminum alloy with special radius groves for oil cooling and special. smooth hard alloy smooth edge for controlling timing of valves-bars with chambers positions, the timing regulation for each valve in one pad or each in a pad , the timing depends on the design data & requirements .

8. Oil is used for lubrication & cooling the power wheel units this oil could be cooled by water or air cooling system in the engine unit or out side.

9. The distribution of cooling water groves in Case are as for industrial design .. for cooling Case and oil.

●   ●

DESIGN PROPOSALS

1. This engine can contain many power wheel units depending on the out put torque power, with a relation to the diameter and number of cylinders in each wheel , the various proposals and options of this system provide a diverse use for it.
    Power wheel units can contain one cylinder or two or three or more for each.

2. The power wheel units could be in different diameter for engines, the principle of piston's moment effect on Crank will be considered in related to output power using the required wheel, cylinder diameter in any engine design ..
    Although the ability of controlling power units performance; as (Shirwan engine). (Fig 2/25,17/25 & 21/25 ,22/25)

3. A double ignition system (accessories) in one large (super) power wheel unite , one or more in engine, simply could be used.(Fig 24/25)

4. The main tunnel(canal) for oil supply in the crank can be out side the crank by special connected parts on all the rotating parts on crank with longitudinal line holes as tunnel(canal) a cross all parts (that stickmen together) parallel with shaft line, in its boundary, with its holes for each oil feeding requirement with regard to balance rotation system .

5. The water can be used for cooling Power wheel units walls by special design for Case in extensions between the wheel units, contain canals for water cooling the oil and near the wheel side walls.

6. The difference of cylinder number in wheels with their accessories required . depends on speed and output power of the engine; (Fig 14/25)

7. The cylinders in each power wheel unit in the same engine could be in various diameter than the other wheel with special accessories as required for Automatic power engine (Shirwan) engine ..(Fig 15/25).

8. The use of different wheel diameter in one multi purposes engine; with special accessories as required ,for Automatic (multi) power engine; (Shirwan)engine . (Fig 16/25).

9. The fuel spray system can be one set for all air- fuel mix ,or can be separated for each power wheel units in the engine controlled by advanced computer systems, as required for Automatic power ; (Shirwan)engine.(Fig 21/25 ,22/25).
    The pre mixed fuel injection (indirect) for charging valves which used here can be substitute by direct injection on chambers by Case fixed device for each wheel.

10. The fuel spray system can be controlled by computer system to maintain the required spray mixture with air and could vary this mix for each type of gasoline octane content by automatically device as required .

11. The places of the big gas mass seals can be changes depending on the design data, the type and way of work depend on the type of industrial production.

12. The exhaust opening could be in different grades openings and angles related to engine design and fuel criteria and could be mechanically changeable control!.

13. The flexible (elastic) system of piston push-arms could be of various types for different engine designs (or even different in one advanced automatic .engine) using metal spring, gas or oil hydraulic device-heat resistance- like those used in automatic gun weapons , it might be more tight and modified by heat increasing .!

14. An advanced new modified system under the name of (connected hydraulic wheel unite system) could be used ,that can get use of the impact power on piston at the firing stroke instantaneously to transfer apart of this power to opposite direction affects on the other piston in the same wheel at a position ;when its combustion gases (in previous action)start to loose from exhaust opening ; in a way to supply an impact press from inside (cylinder) to push piston outward pressing on those gases, in chamber, accelerate them to fast release from graded opening , which will create reaction on opposite direction increase torque with additional power on wheel, this technique of connecting resistant system of two pistons in one wheel is a very advanced modified system as a part of this development researches as many other patents included in this system .(Fig 12/25).

15. The ordinary oil pump can be concealed in the engine if a special design for the oil tunnel in Case directed oil to the feeder tank for central oil tunnel in the engine crank . the oil will naturally flow due to rotation of a huge natural centrifugal oil pump(s) of cooling-lubrication pads which radian grooved in a required way (especially the last pad).

16. The ignition distribution can be in advanced electric design , It might need a dditional timing device as for old system but with more simple method, and even can use the electronic computerized device due to the fast rotation of engine as one part of computer system research of this patent ..

17. The fast circle rotation of wheels will cause loss air pressure inside chambers (if empty) but charging pressured air-fuel mix from out side in this system will supply the air mix in a proper pressured way ,and since the existence of elastic piston movement., It will correct the chamber space in related to the best fuel combustion to be occurred in a perfect way, i.e. maximum energy, with the homogeneous reaction on engine even in changing the fuel mix details in some pistons.

17. The metal industry for wheel allies , its grooves and tunnels can be easy done with facilities of metal and casting drillings available in recent manufacturer. (Fig 9/25)

18. This engine could be design for vertical crank shaft direction with the same principal of this system to be used fore Hoover craft and flying equipment.

THE DRAWINGS CONTENTS

Important note :

The drawing are assumed in typical(assumed) dimensions for A2 size drawings in Autocad diskette program to declare the compositions of engine but not the same scale for A4 although not necessarily for industrial design requires.

DRAWING DETAILS - DECLARATIONS .. (ALL DRAWINGS)

1. Chamber (combustion room)

2. Case (engine Chassis).

3. Wheel (Power wheel unite -energy unit).

4. Anti-scratched alloy (modified wheel surface) .

5. Metal spring (straight or inclined).

6. Crank (power-torque crankshaft).

7. Piston push-arm (flexible shaft device).

8. Piston push-arm base. (cylinder base).

9. Spark plug .

10. Piston lubrication pump (built in ,not as scale of drawing).

11. Oil tunnel (canal) for piston lubrication feeder.

12. Bolts for fixing seal base (in Case).

13.   Pinion ring to transfer rotation to other device(for ignition..etc).

14.   Solid steel ring for piston lock (in cylinder)

15.   Canal in case for oil system (flow back).

16.   Regulator adjustment for big seal mass .

17.   Pad for cooling & lubrication .

18.   Ring seals in piston .

19   Big seal mass in Case (anti-gas).

20.   Air-fuel mixture- charging's system (pre mixed fuel injection).

21.   Pressured pure air-(scavenging of chamber); charging's system .

22.   Valve (one way -air check valve) .

23.   Canal of water's cooling system in Case .

24.   Central oil's main supply canal .

25.   Engine base flexible holder.

26.   Big circular wheel oil seal , wheel slide -bearing (anti-gas ,anti-oil).

27.   Ball bearing device

28.   Oil pump (for engine).

29.   Water pump.

30.   Exhaust aerodynamic special opening.

31.   Cladding perforated   hollow pipe .

32.   Main assembling bolts for Case

33.   Ignition distributor

34.   Feeder oil tank for engine

35.   Oil sump

36.   Oil pump intake

37.   Oil supply pipe

38.   Oil refill   opening

39.   Oil locked washer

40.   Tightening ring (washer with pin)

THE CLAIMS ON THIS INVENTION
(In addition to the proposals and specification mentioned which may add later)

1.   This principal of a new internal combustion :   engine using wheels rotating inside
the engine case , these wheels contain cylinders with its pistons which have the
abilities of linear movements inside each cylinder , all wheels fixed on the same
straight main crank shaft ,each wheel conducted separately with its seals , valves,
spark plug and exhaust pipe.
The cylinders placed in center-side of each wheel as the required discipline for
each engine design , each contains piston with design relevant flexible elastic
push-arm, the chamber for each cylinder is in the circumference zone of wheel .
The air -fuel mix charged in pressured situation from outside by the required
accessories , by a valve away from firing portion , the wheel circumference
guarded by anti gas seal in three portion or more fixed in the case to separate mod
of the chamber mix zone (stroke situations)during the work of the engine.
When engine rotates ,chambers charged with pressured air-fuel mix reach the
firing zone ,it spark by a plug ,the explosion of the mixture and gases expansion
will push the piston ,e.g. the wheel to rotate , but keep the resisting of the arm in
energy charged (depressed) situation .
The pressured gas pad exist in the chamber will be in a standard high pressure by
kept locked from all sides while still rotates in wheel circumference, using the gas
character in closet space like Palo to reflect the act of the piston which keeps
pushed to return to its place by the elastic push arm beneath , to counter this force
chamber gases pressured again to the piston e.g.wheel with additional positive
power of hydraulic reaction .
When the chamber reaches the last exhaust gas seal ,the under pressured after
combustion gases in chamber start penetrate ,but from specific exhaust opening
utilizing the aerodynamic principle with the use of pressured situation of the
combustion gases and the charged elastic resistance of push-arm under the piston
to make this force more affect .
This additional power of the aerodynamic force will act on cylinder e.g. on wheel
with more positive power .
The resultant of all these powers on cylinder will maximize the power of said fuel
consumption for (said) relevant power -weight ratio ,using mathematics criteria .
The circular zone of the chambers place on the wheel with its elastic piston push-
arm resistant , the centrifugal principal ; in case of increasing speed will affect the
fuel consumption in the chambers for the said , may be reduced rapidly (by using
mathematics calculation , accessories control)
A new design principal of internal combustion power engine using chemical fuel
energy in high efficiency by adding to it potential physical powers that agitate
the nature principle due to dynamic effect on elements in this engine and on
gases those appear due to the new mechanical design which will increase output
and reduce the said fuel consumption, i.e.a new way of magnifying the fuel
chemical combustion energy by using the advantages of dynamic nature
physical principles.

2. A new system in compacted engine has a high efficiency related to power -weight ratio with the ability of using various piston power stroke(different compression ratio) in one engine to act on the same (or bearing zone of) torque crank

3. A new design using combination of pistons with rotary combustion principles together in one compacted engine and utilizing dynamic of exhausted gases as turbine affection to act all positively in increasing output torque .

4. Using a new industrial design of wheel power unit(s) as energy unit(s) in internal combustion power engine (with new placing of pistons and cylinder in engine) with the ability of independent piston(s) performance in this system .

5. Using wheel units principal in transferring combustion energy to torque movement with the minimum energy loss in engine due to new mechanism .

6. Using a new design for power crank (shaft) in this system as straight solid bar with central tunnel(canal) for oil feeding as a pipe , (or just a straight solid bar) .

7. Using a new way of transferring fuel combustion power to torque movement without frictional affection of the main parts under stress that reduces the heat in the engine and without use of slipping bearing pads on torque crank . the system substituted them by chamber gas pad which are in the circular zone moving contacting the case .

8. Using flexible piston push-arm which provide a good efficiency for fuel combustion, in any situation or any mix rate (different compression ratio) due to independent piston performance.

9. Using a new principle of central oil supply tunnel (canal) for lubrications and for cooling depending on engine rotation by the Physical Centrifugal principle .

10. Using a new special system of separate pistons lubrication device that supplying oil to piston movement as its demand (in the cylinder) independently.

11. Using pressured air-fuel mixture charged to the engine with fuel pre-mixed as used in Jet engines for a better combustion efficiency in squeezing more power in this spark ignitions engine which bearing various powerful fuel energy .

12. Using a new l design for air-fuel mixture Inlet valves with simple un fultable timing mechanism placed in a portion far from firing stroke and using different exhaust place opening (fixed or regulated) in this system .

13. Using a new design of elastic pistons return for expel exhaust gases in exhaust stork which spare this energy that wasted in conventional engines.

14. Using the advantage of potential aerodynamic reactions of exhausted gases to add more output power for engine depending on gas turbine principle.

15.   Using a new principle of air cooling and scavenging inside chamber on hot pistons cup directly during ending of exhaust stroke with its adiabatic affection good improvement

16.   Using a principle of flexibility in transferring fuel combustion energy to torque power by using elastic device resistant that apply smooth performance engine .

17.   Using a design that eliminates the old valves system with its articulated connection, belts ,gearing wheels ,noise, it's weights, high speed's failure and it's expected easy oil smoke leakage .

18.   Using a slipping design that allows slow or high speed rotation safely and smoothly .

19.   Using a design that reducing pollution within the engine discipline by using pressured air directed(regulated) to hot gases in chambers while still hot which complete oxidization of all exhausted gases i.e. on CO &NOx to be more friendly to environment and also eliminating soot articles

20.   Using a way of maintaining the perfect fuel combustion in chambers, by using flexible space due to piston push arm , that maintains the required space (chamber) for perfect fuel combustion maintaining the best firing gas compression ratio situation for each fuel regardless of fuel type..(or fuel mix rate)., however the flexibility of the system will maintain all resultant energy to be used perfectly and positively on Crank ,terminating: knocking , rumble that exist in conventional engines, or any other related performance problems .

21.   Using this design :of flexible push-arm pistons with chamber places, moving in a wheel circumference that provide advantages of the circular merical shape : in reducing the reciprocating movement of working pistons in descending way with the increase of speed depending on Elastic push-arm character (depressing) and the Centrifugal principle(i.e.weight of piston mass) .A conclusion equations could reduce the fuel needs in high speed due to approaching a situation of minimum piston movement, keeping high reactions on wheel at high speed , this means descending of fuel mixture needs rapidly for the said speed power due to speed increase, i.e. means descending in fuel consumption with speed increase.

22.   Using a new way of lubrication and cooling system with a good efficiency in high speed ,and the oil sump(tank) far from the pistons bases e.g. pressured exhaust hot gases effect if leakage happened .

23.   Using the ability of this system to control the engine output by stopping engine parts i.e.any piston(s) performance could work or terminated as required despite they are in the same crankshaft during rotation without influencing on other parts.

24.   Using the principle of gun- weapon automatic emission gas re-fill in automotive fuel engine .

25. Using a practical new way of reducing fuel consumption, by monitoring the required power parts , for the exact performance needed for engine work's demand, using the required accessories for automatic output(Shirwan Engine)

26. Using various ways of regulating and adjustments of most engine activities .i.e. fuel consumption, oil cooling system ,output power , pollution treatment . The seal mass contact on wheel circumference could be controlled mechanically or by thermal adjustment with relation to engine speed or engine heat or as required i.e. from out side ..

27 Using various proposals in manufacturing depend on design principal as different: power wheel numbers , diameters ,cylinders diameters or cylinder(piston)numbers in each wheel ,or using connected hydraulic system,for two pistons in one wheel..

28. Using an easy way of charging the air- fuel mix separately to each power unit as required with a relation of automatic power engine for each power wheel unit (energy unit) by electrical ,computerized control system for automatic output to be multi power output ..as ..Shirwan Engine

29. Ability of using Gas fuel or jet kerosene by the same principal system with their accessories changes.

30. A system could be used vertically according to crank direction as vertical engine crank shaft with perfect output efficiency for using in flying equipment. (Fig 23/25)

31. Multi purposes engine i.e. automatic performance engine could be done by using these various proposals for automatically controlling devices :
a/ Air fuel mixture charging pipes opening control regulator for pistons in one wheel
b/ Air fuel mixture charging pipes opening regulator for each wheel unit(energy unit).
c/ Different pistons diameters in any wheel with their particular accessories .
d/ Different wheels diameters with their particular accessories
e/ Different piston groups push-arm (elastic resistance) for particular wheel(s) that might use in special performance i.e.fast acceleration ,high speed or in heavy work.
f/ Exhaust opening angle and direction, location of terminal exhausted seal-mass.

32. This system will use the maximum potential fuel energy:
It's because of constant (longer)moment arm affection of power stroke on Crank.
It's because of all positive affection for all piston's movement(stroke) on Crank .
It's because of less combustion energy loss due to the system machinery.
It's because of utilizing the elastic potential force of an element in push-arm.
It's because of utilizing the best combustion of fuel in chamber at any time.
It's because of using the pressured charging fuel mixture to the engine.
It's because of utilizing the exhausted gases dynamic turbine power in output.
It is because of utilizing the physical powers occur in this mechanical discipline

29

TYPICAL SHAPE – SIDE VIEW
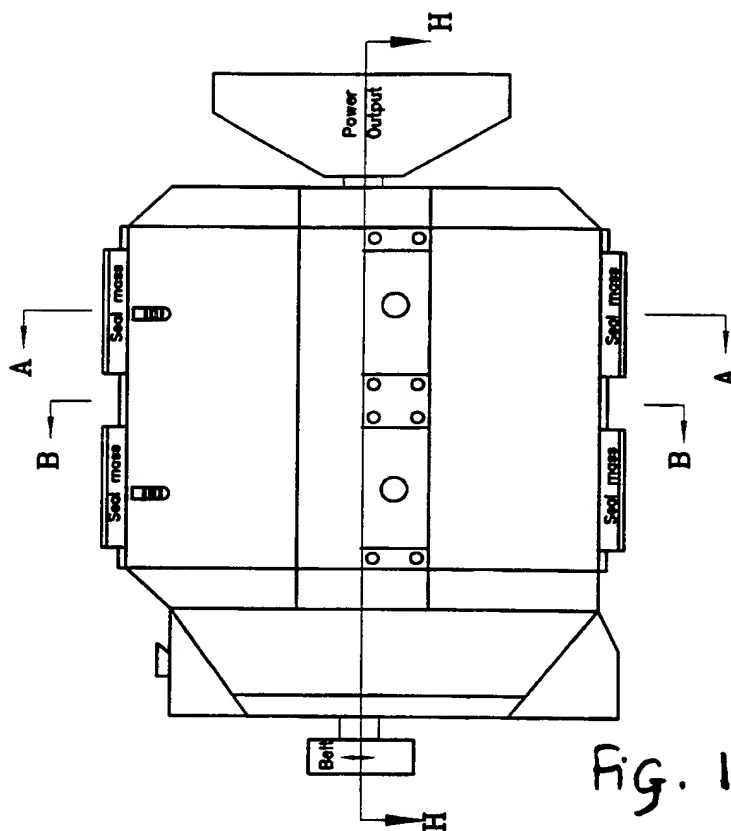
Fig. 1a
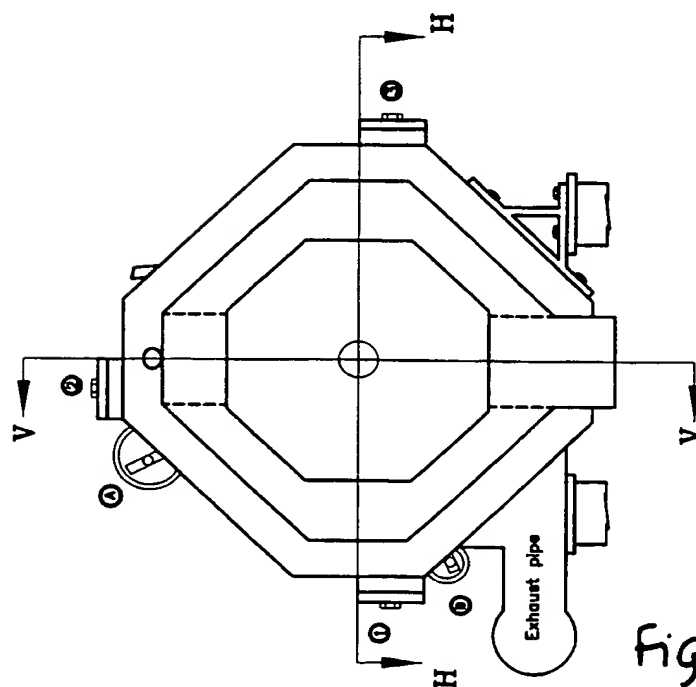
TYPICAL SHAPE – FRONT VIEW

Fig. 1b
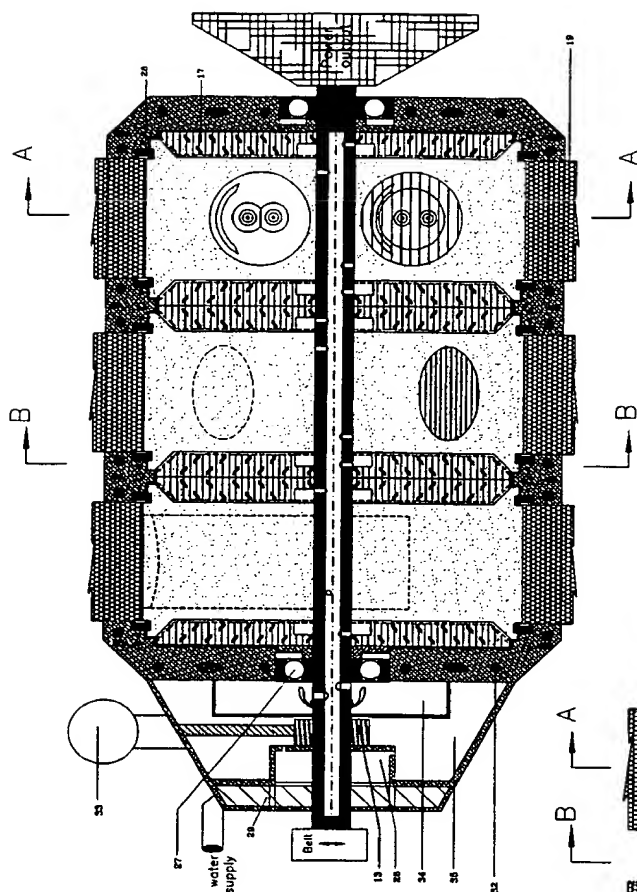
Fig 2b

THREE POWER WHEEL UNITS
Section plan in horizontal center line (sec. H–H)
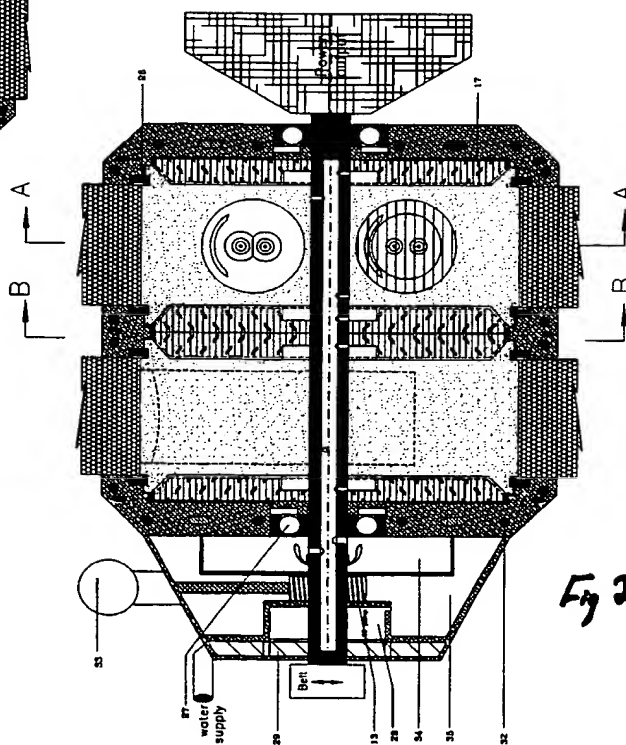
Fig 2a

TWO POWER WHEEL UNITS
Section plan in horizontal center line (sec. H–H)
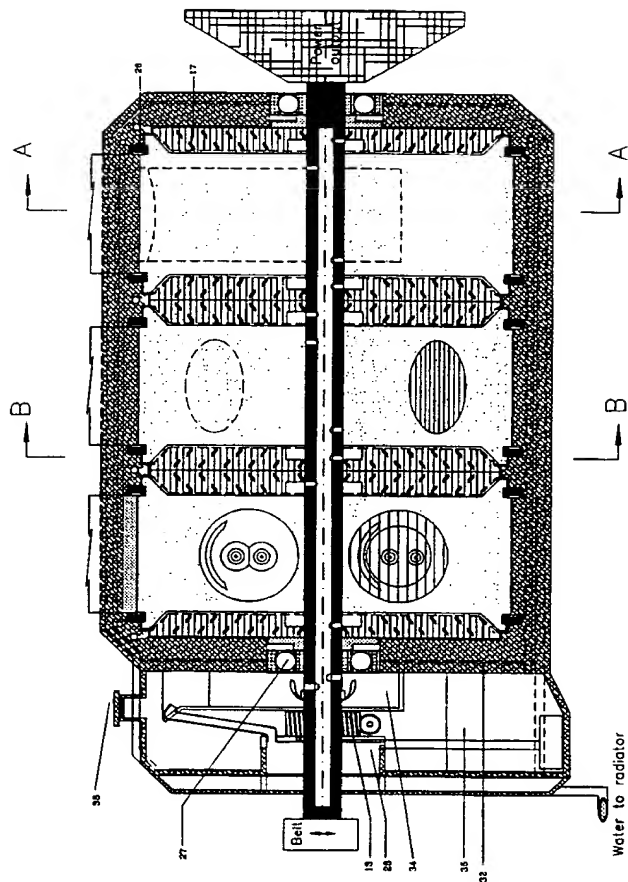
THREE POWER WHEEL UNITS
Section plan in vertical center line (sec. V-V)

Fig 3b

Water to radiator
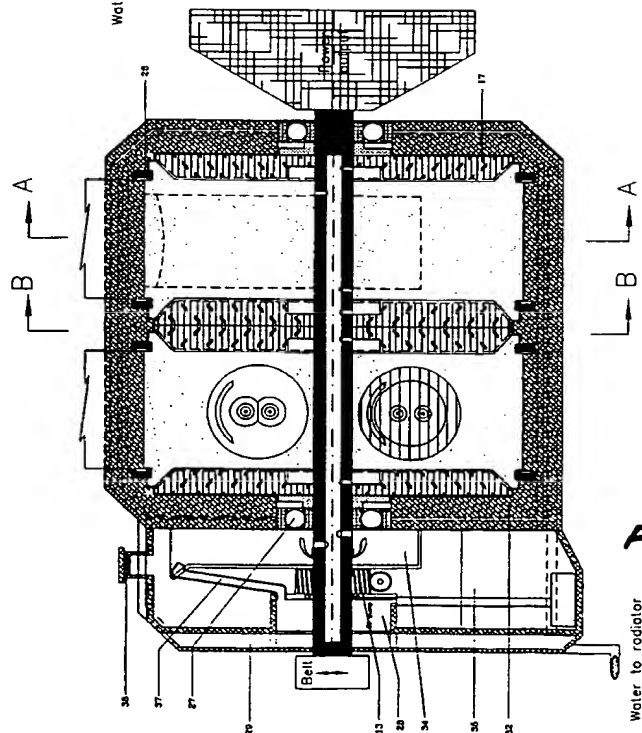
TWO POWER WHEEL UNITS
Section plan in vertical center line (sec. V-V)

Fig 3a

Water to radiator
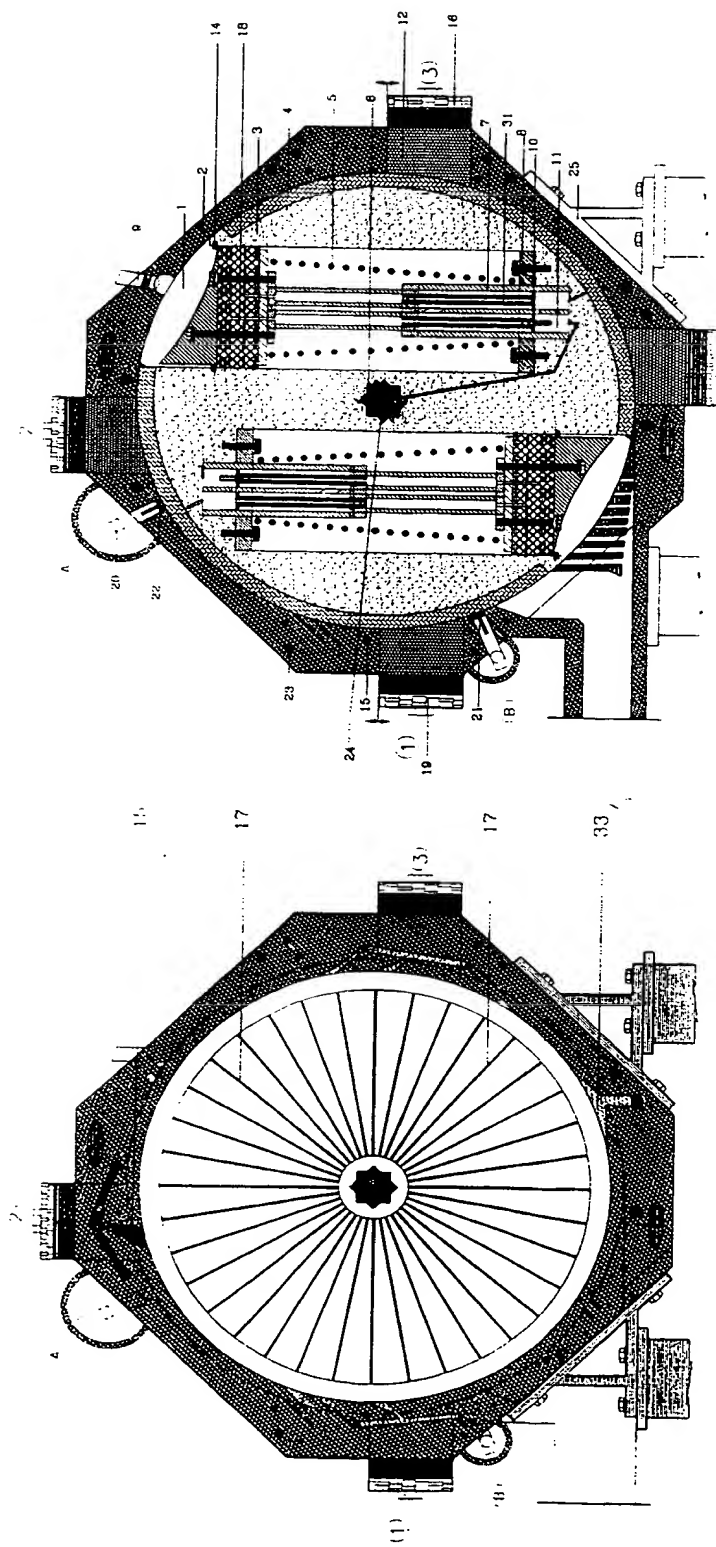
Fig 4a

SECTION A — A
Section plan at vertical c. l. of power wheel
(A typical spring power modified)

Fig 4b

SECTION B — B
Section plan at pads for cooling & lubrication
(between wheel units)
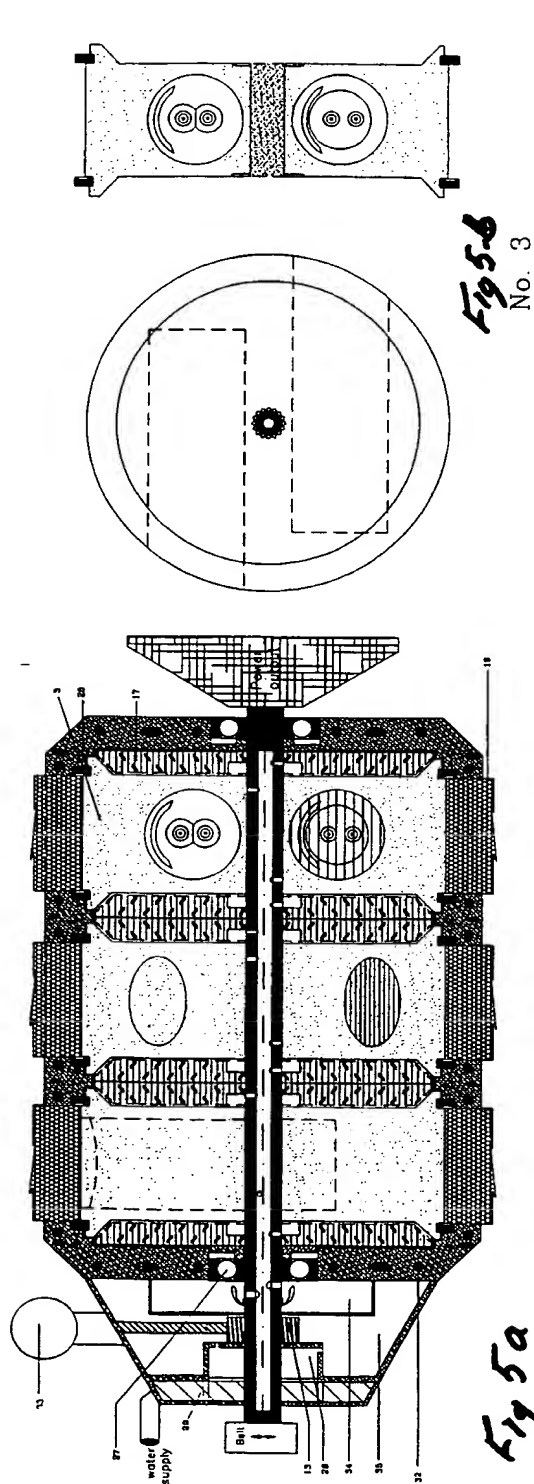
Fig 5b
No. 3

Section ~ Plan in horizontal C.L.
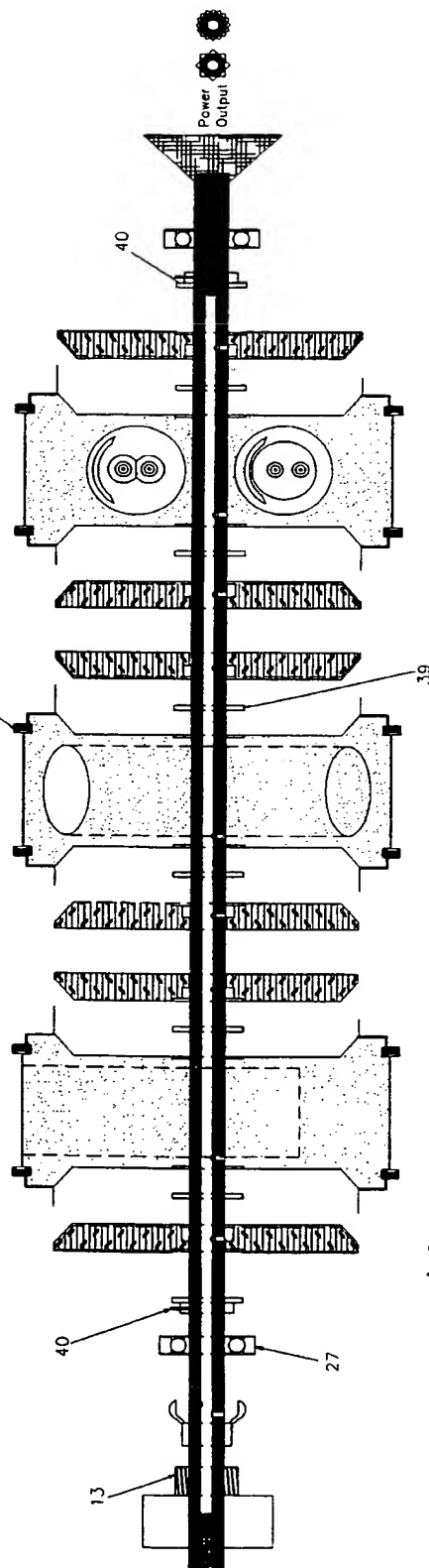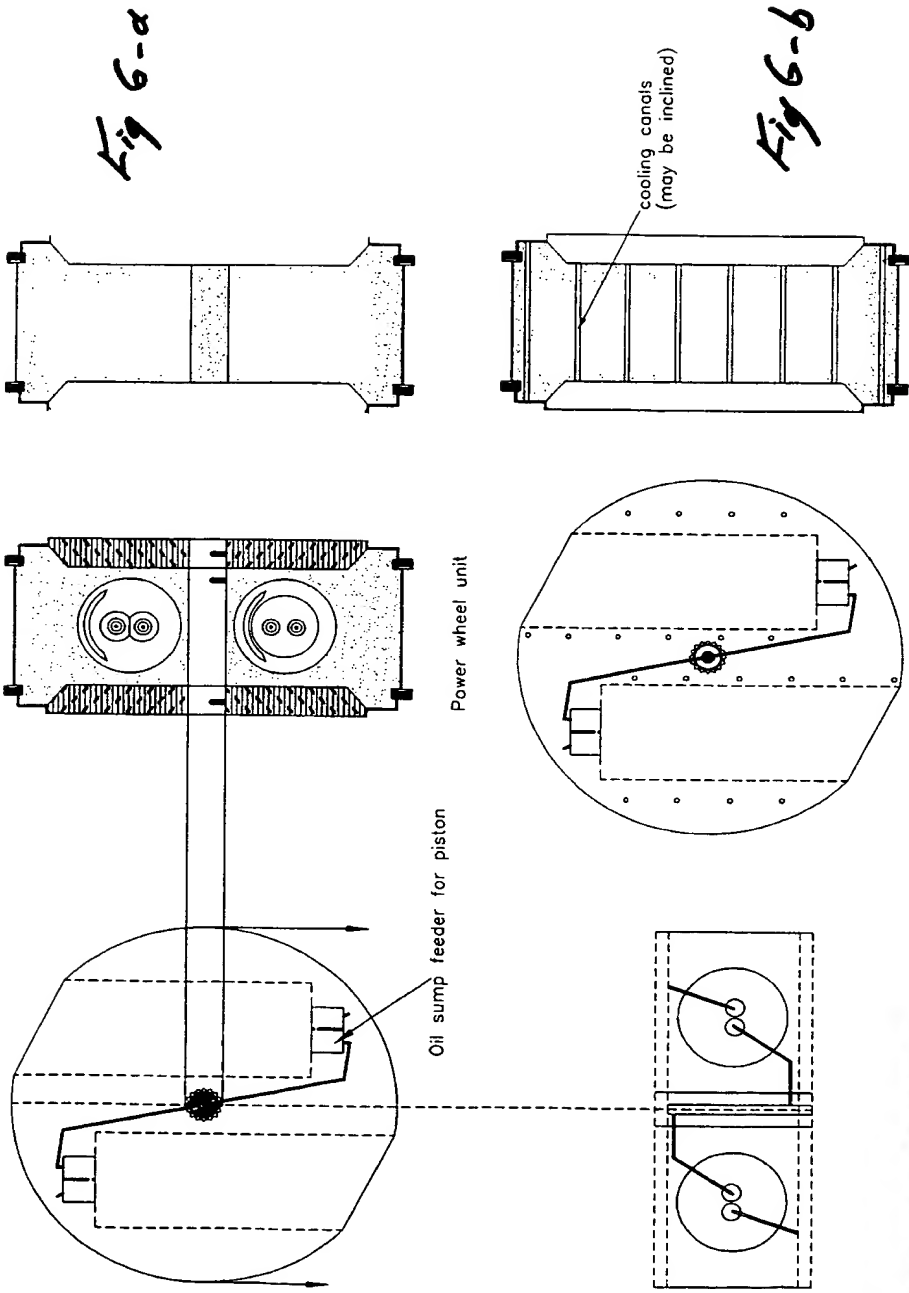
Fig 5a

Fig 5c

ROTATING PARTS ANALYSIS ON THE CRANK

Fig 6-a

Power wheel unit

Oil sump feeder for piston

Fig 6-b

cooling canals
(may be inclined)

Proposal for additional cooling oil holes in the wheel

PISTON INLET OUTLET OIL SYSTEM

case

Valve mechanism
1st proposal

Timing bar

Fig 7C

case

Valve mechanism
2nd proposal

Timing bar

22

Metal spring

Fig 7a

17
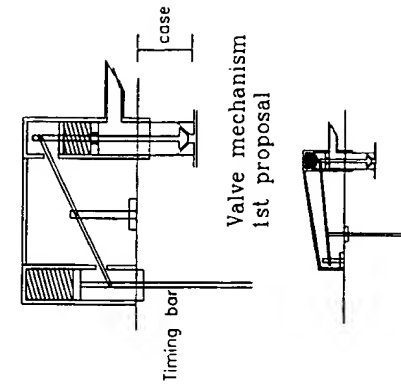
Fig 7b

1st proposal of timing system
for valve mechanism
(Lower points pad circuler edge)

Timing bar for
air_fuel mixture

Timing bar for pressured pure air
(near exhaust portion)

Oil pad
lubrication cooling

one pad – two valve timing system ... d
(Typical performance)

Fig 7e

Circular oil space

Oil tenches
(wheel side)
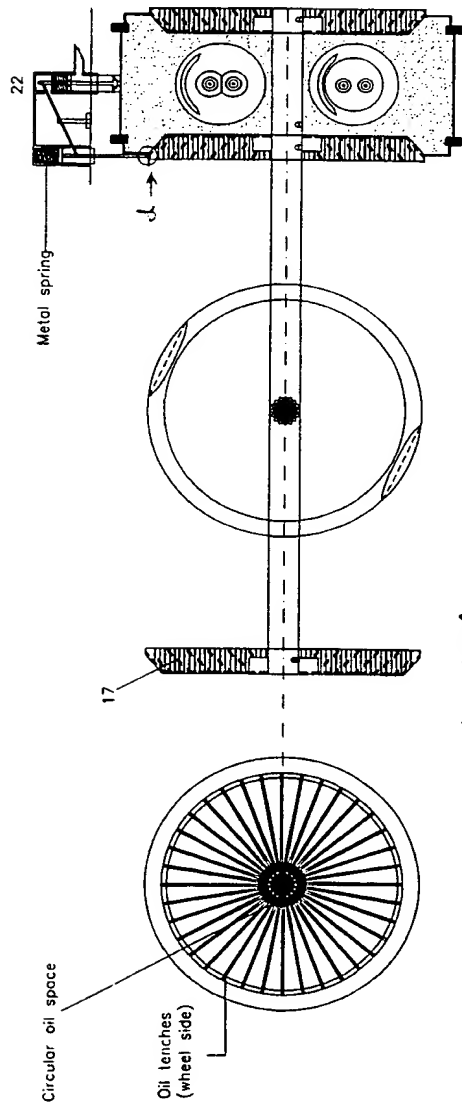
Cooling lubricator pad
(Detail 17)

2nd proposal of timing system
for valve mechanism
(Higher points pad circuler edge)

Fig 7d

Fig 8a

Fig 8e
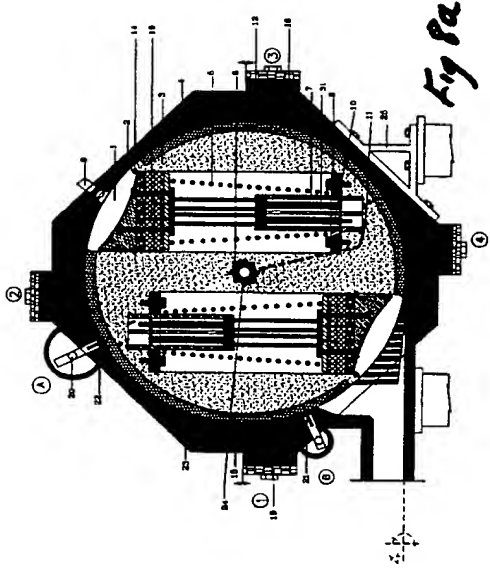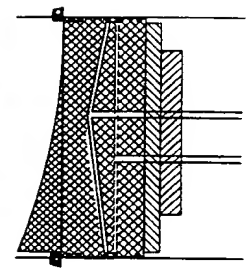
Proposal
For the piston, lubrication
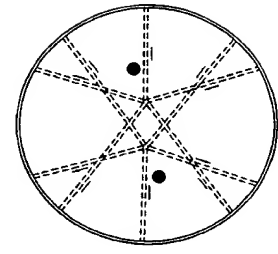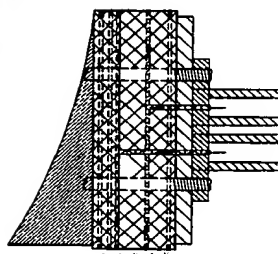
PISTON OIL CANALS DISTRIBUTION
Scale 1 : 1.5

Fig 8c
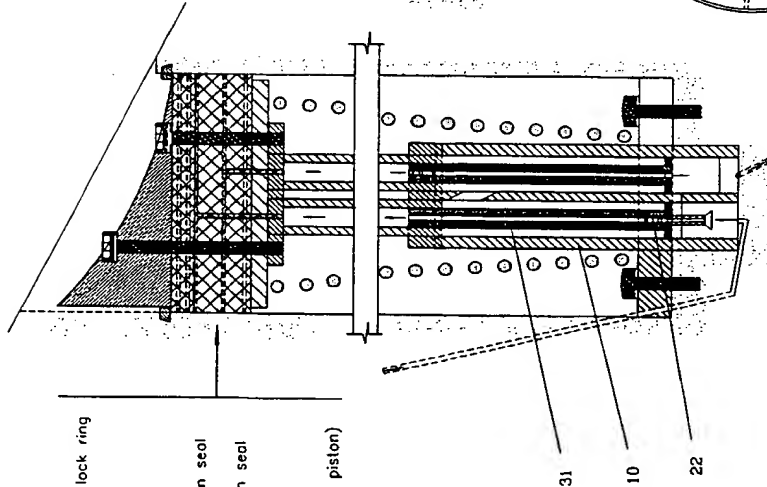
Fig 8b

TYPICAL CYLINDER_PISTON

31
10
22

Solid piston lock ring

Piston gas seal

Piston oil seal

Piston lubrication seal

Piston lubrication seal

Piston oil seal

(As perticular in piston)
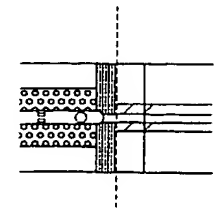
DETAIL 22

Fig 8d
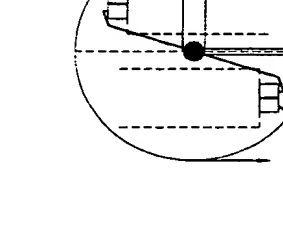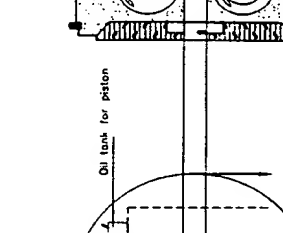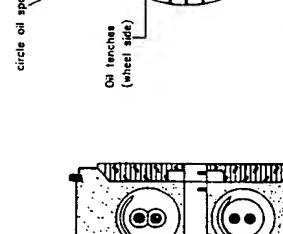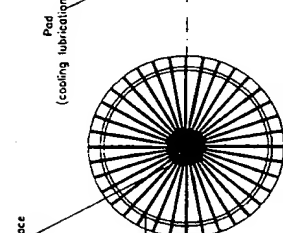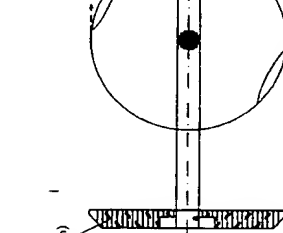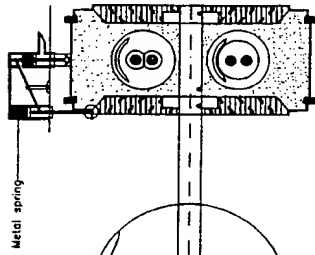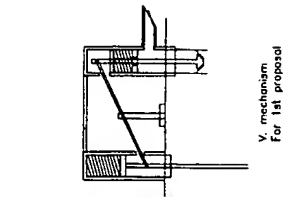
V. mechanism
For 1st proposal

Fig 9-d

V. mechanism
For 2nd proposal

Timing bar for air-fuel mixture

Metal spring

1st proposal of timing system
with valve mechanism
(Lower points pad circuler edge)

Fig 9c

Timing bar for pressured pure air
(near exhaust portion)

Oil pad
lubrication cooling

Fig 9e
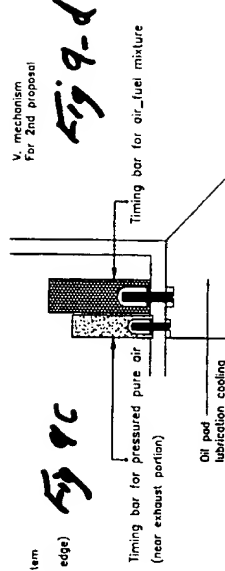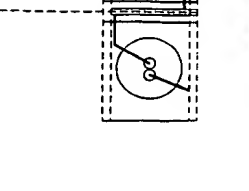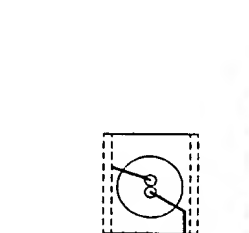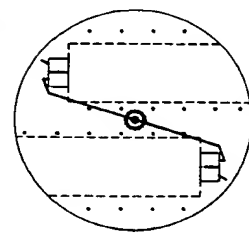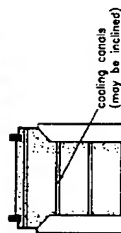
(one pad - two valves timing system)
(typical performance)

Pad
(cooling lubrication)

circle oil space

Oil lenches
(wheel side)

LUBRICATION COOLING PAD

2nd proposal of timing system
with valve mechanism
(Higher points pad circuler edge)

cooling canals
(may be inclined)

Fig 9b

Proposal for additional cooling oil holes in the wheel

Power wheel unit

Oil tank for piston

PISTON INLET OUTLET OIL SYSTEM

Fig 9a

ROTATING PARTS ANALYSIS ON THE CRANK

Fig 9f

Oil pump

NOTE
(Oil inlet hole on shaft as per each part it is not as per scale)

SECTION A – A

t   hight of piston cap
s   diameter of piston

NOTE:
GAS SEAL MASS
① ② & ③ Can be replaced in different
places as required and could be four pieces
in suggested place depends on the
outlet ∠-angle and other criterias.

b>c
b>t+t/2a
d>a
a, b, c, e, f (radian distance)
d : piston scavenging distance (pure air)
e : graded exhaust opening
g : exhaust wide open
p : fuel power zone
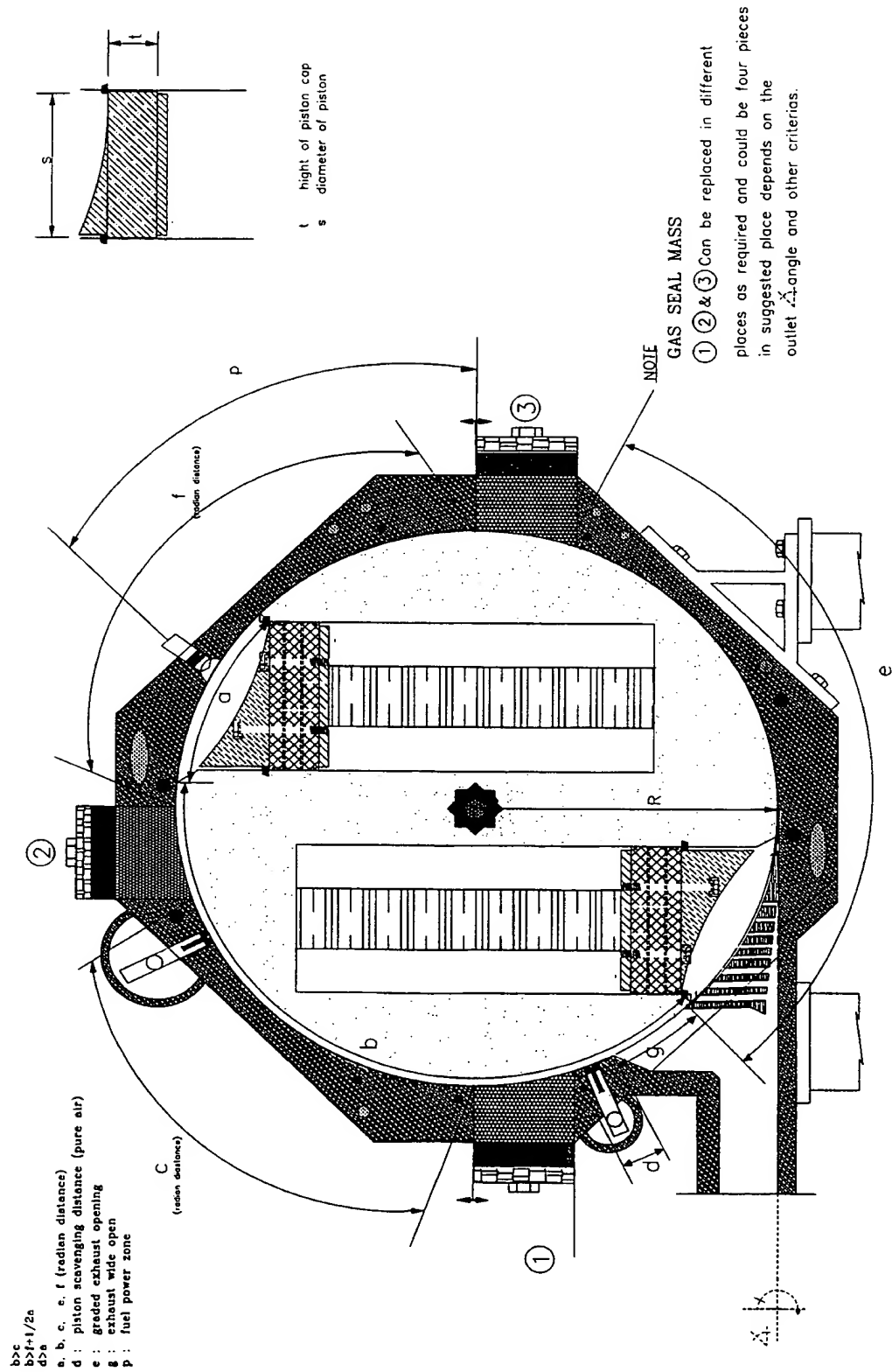
C.A.P. : Compressured Air Device.

L.H.P. : Liquid Hydraulic Device.

C.A.P. or L.H.P.
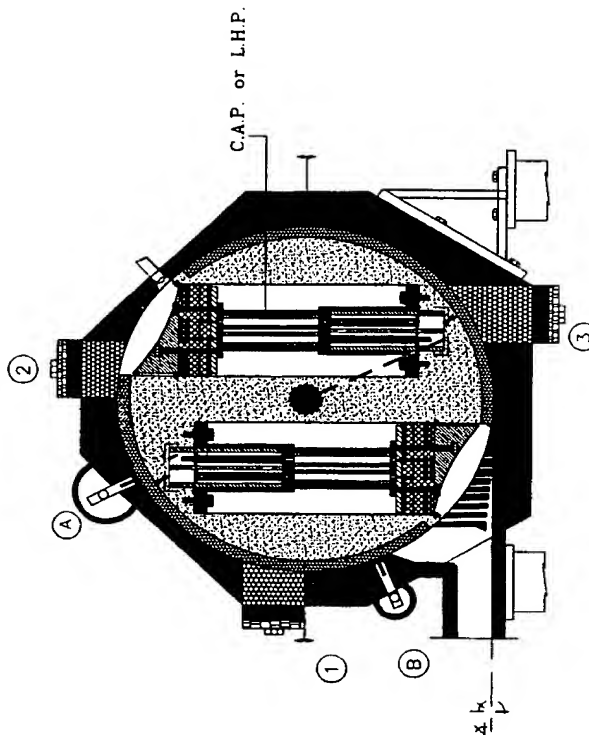
Hydraulic (device) pus-arm modification

Compressured air power modified
or liquid (oil) power modified

Fig 11b
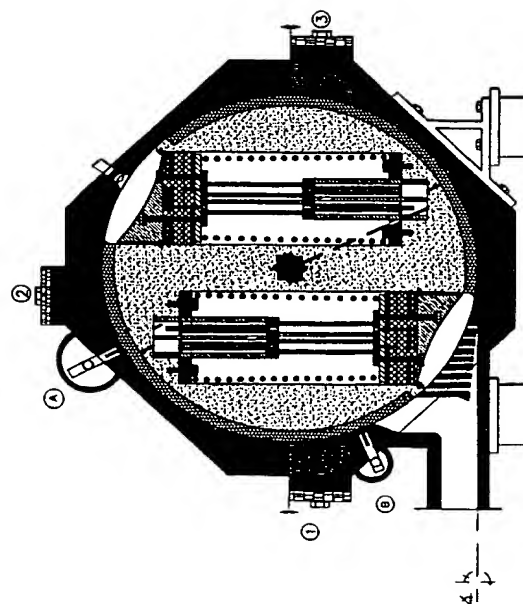
Spring push-arm modification

Fig 11a

C.H.S. : Connected Hydraulic system Push arm WHEEL

Section of system (typical)
Combined hydraulic push-arm system
Compressured air push-arm modified
or Hydraulic liquid push-arm modified
(two piston hydraulic connected system)

ROTATION

fire stroke

exhaust pipe

exhaust stroke

Proposal: 2
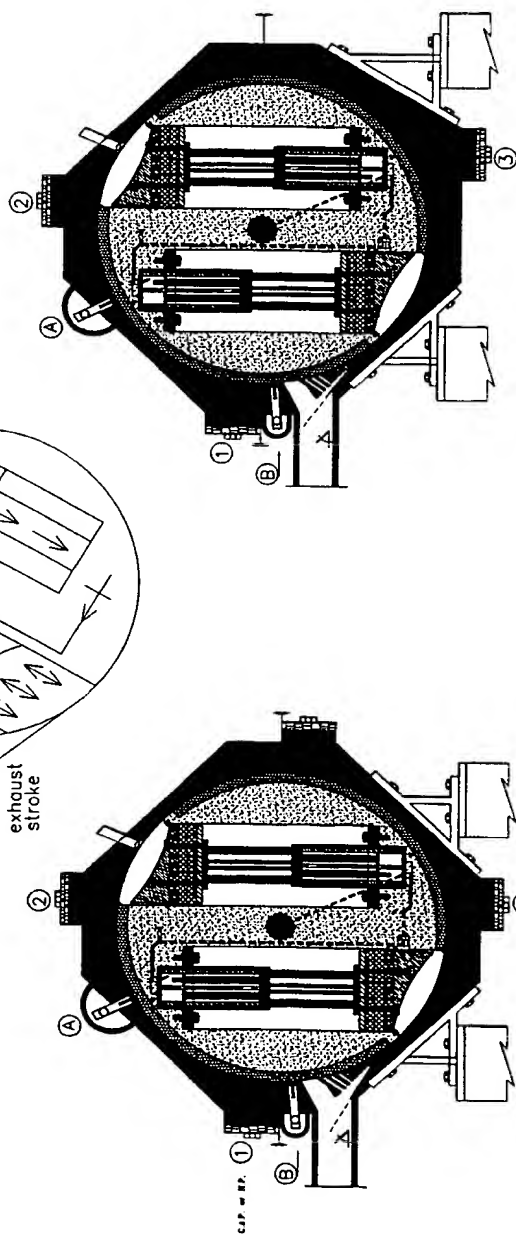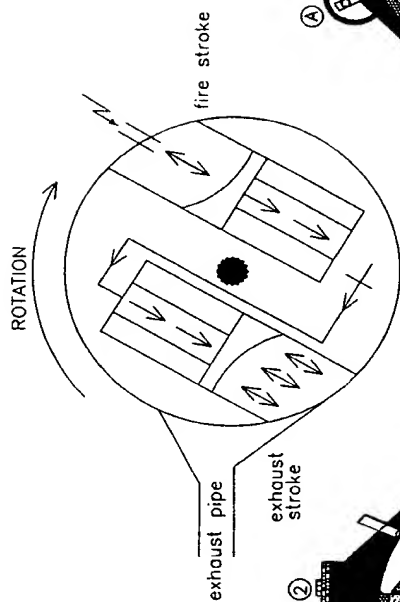
Fig 12 b

Proposal: 1

Fig 12 a
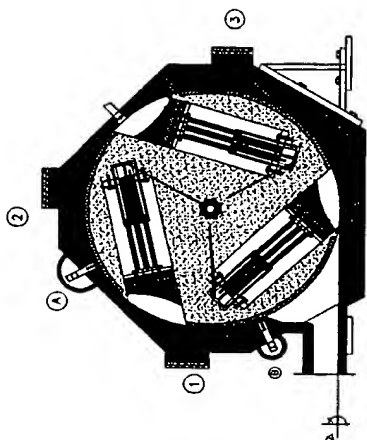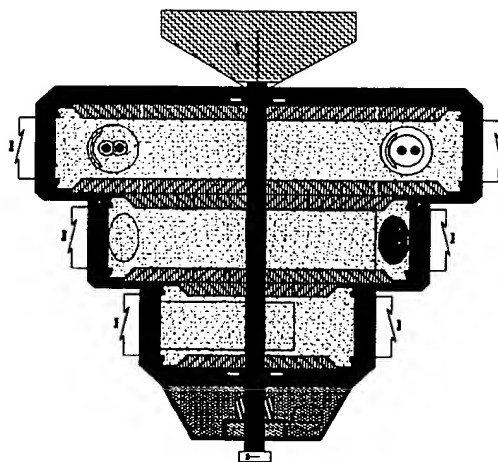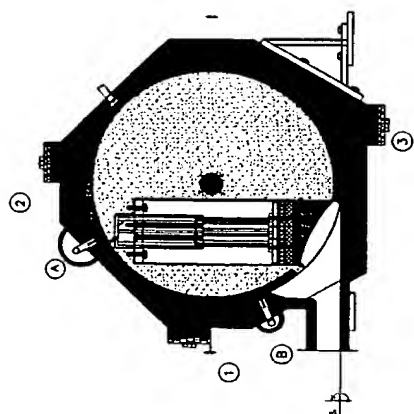
Fig 13b

Fig 13c

Fig 13a
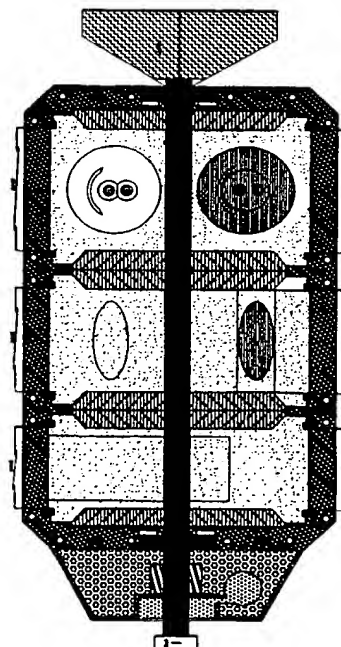
Fig 13d
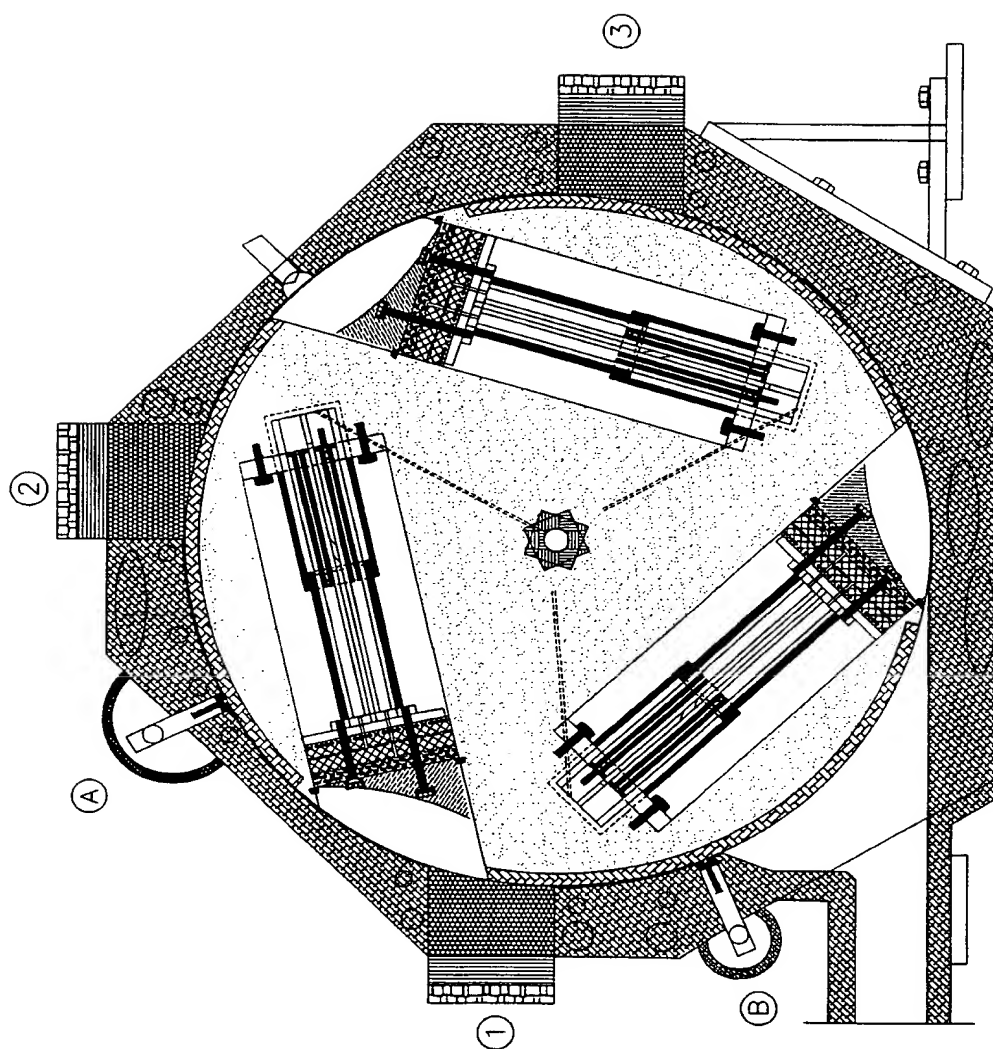
FiG. 14
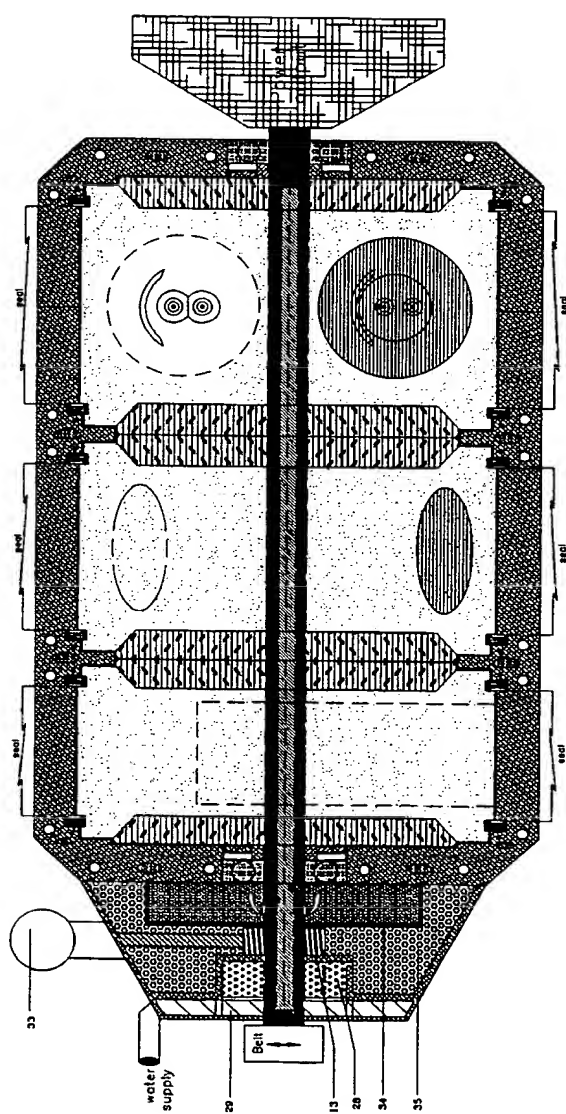
F.G. 15
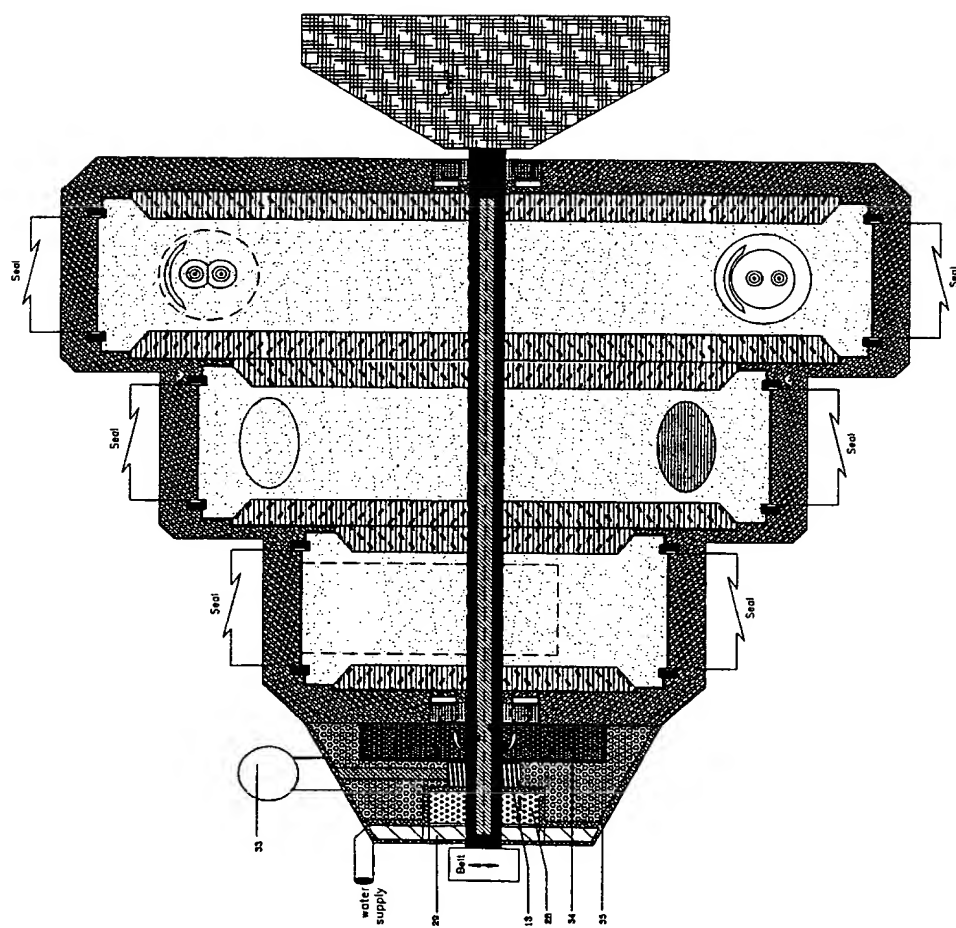
FiG 16
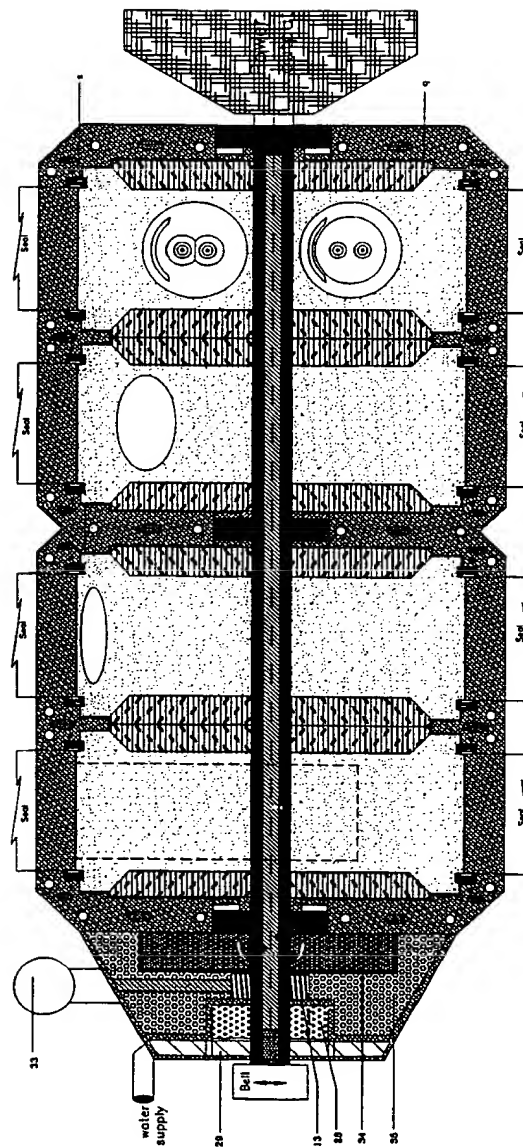
FiG 17

SHIRWO SYSTEM ENGINE
DETAILS OF ENGINE FORCES

Internal
combustion
energy
I.C.E.

Aerodynamic force
AF

Slow speed

P = I.C.E + A.F.

Fig 18a.

Internal
combustion
energy
I.C.E.

Centrifugal force
CF

Aerodynamic force
AF

Fast speed
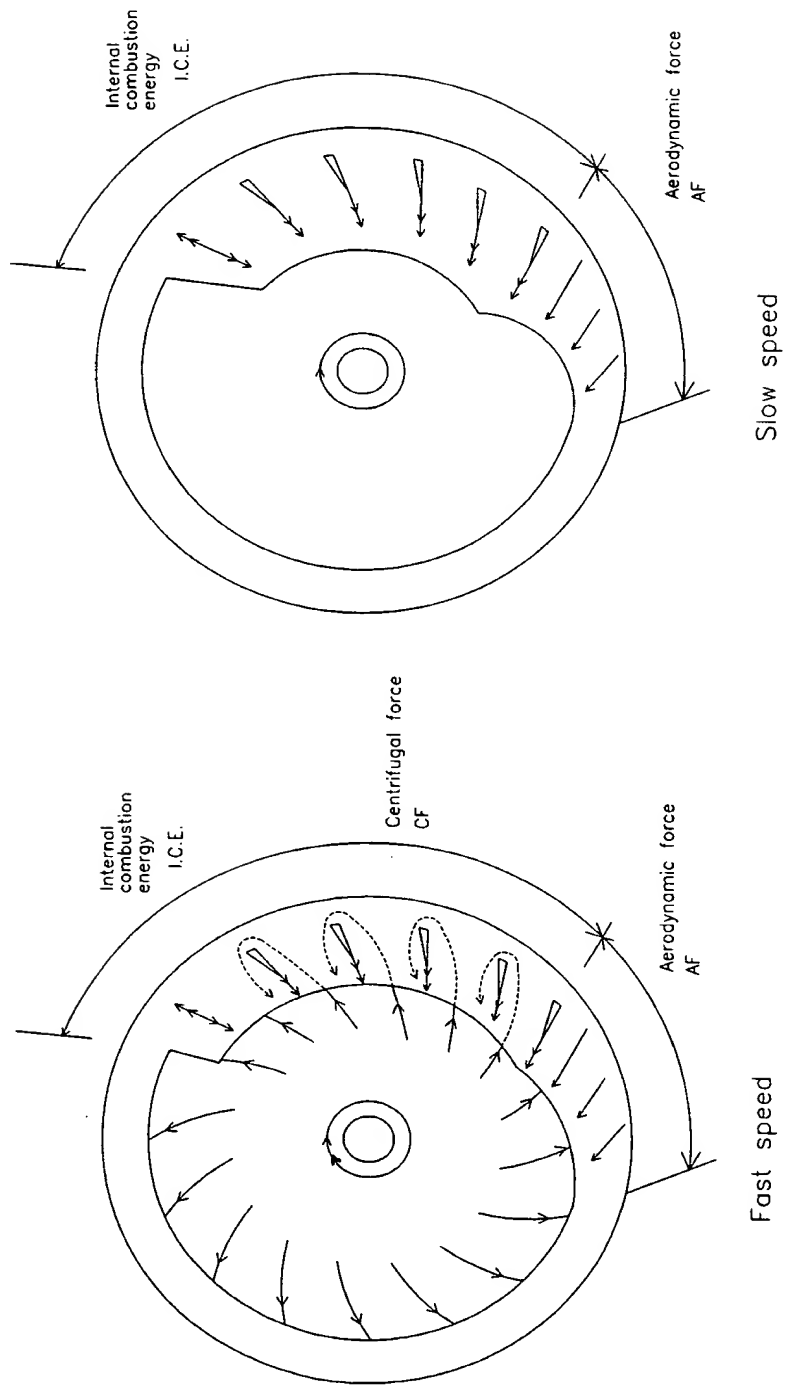
P = I.C.E. + C.F. + A.F.

Fig 18b

NOTE

Component elements are not in actual scale

TYPICAL ENGINE PERFORMANCE

Starting the engine by
electrical motor starter
charging fuel to piston (o)
(HALF CYCLE FOR ONE WHEEL)

Ignition of piston
(o) starting self
rotation

Ignition piston(b)
continue rotation

FiG 19

Oil out

Oil in

Oil in
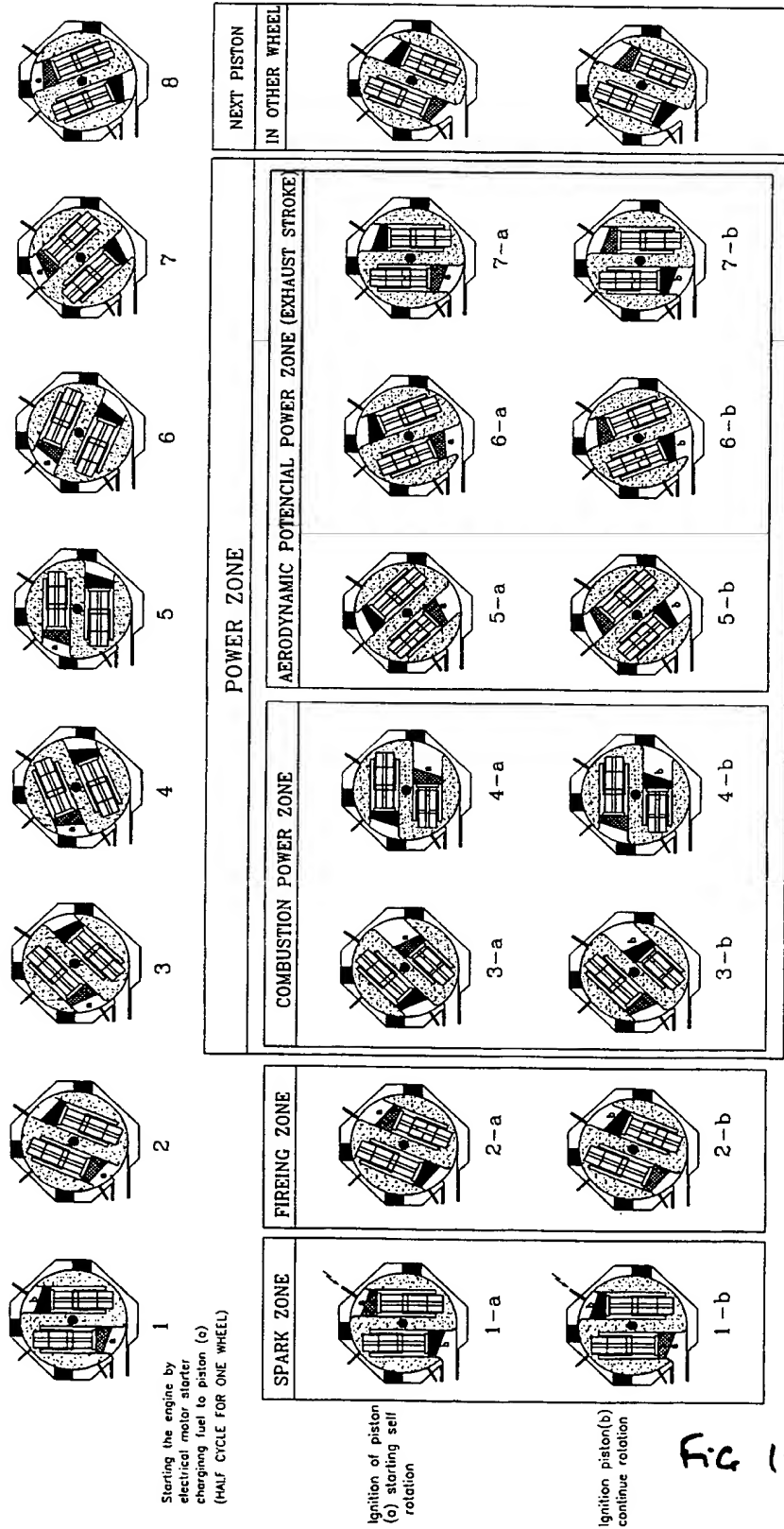
Proposal for seal mass

Section a – a

Fig 20

Simple ignitions distributor
for two pistons wheel
mechanical or electrical

compressured pump

air in

pressure save valve

compressured
air cylinder

elec. fuel pump

generator motor belt

sparying valve
device

in

out

20

Electrical control valve

bar control from accelerator
for compressured air valve

22

exhaust

starter motor

oil
pump & tank

water
pump

33

water radiator

fan

Proposal No: 1.
Fuel spray injection for-(all) – fuel.air–mix inlet

Fig 21

Simple ignitions distributor
for two pistons wheel
mechanical or electrical
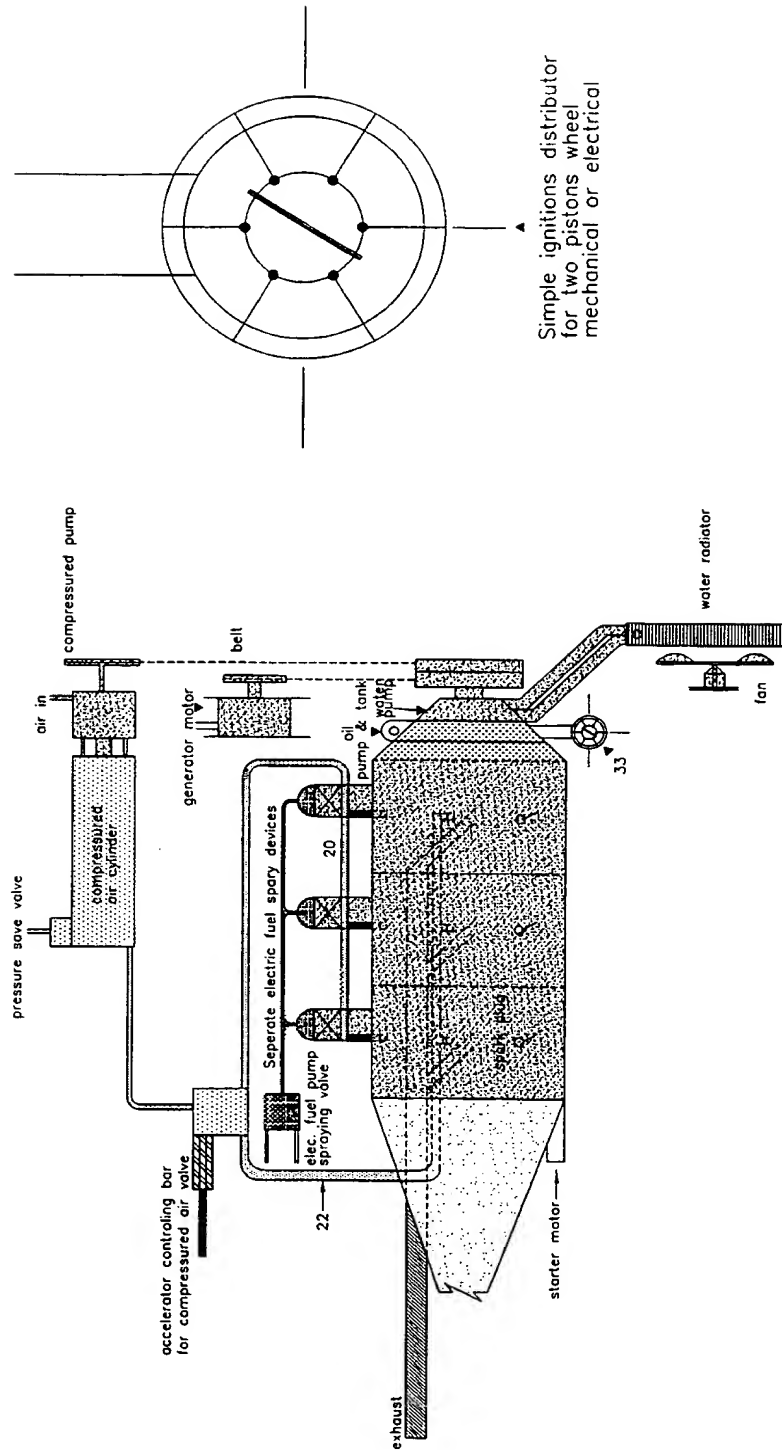
Proposal No: 2.

Fuel spray injection for each energy unit (separated) – fuel.air–mix inlet

Fig 22

Typical unit with vertical crank shaft

Output

Seal   HV

Seal   HV

Bell

Oil pump not necessary
(Using any oil cooling proposal)

One big power wheel unit
(One big energy unit)
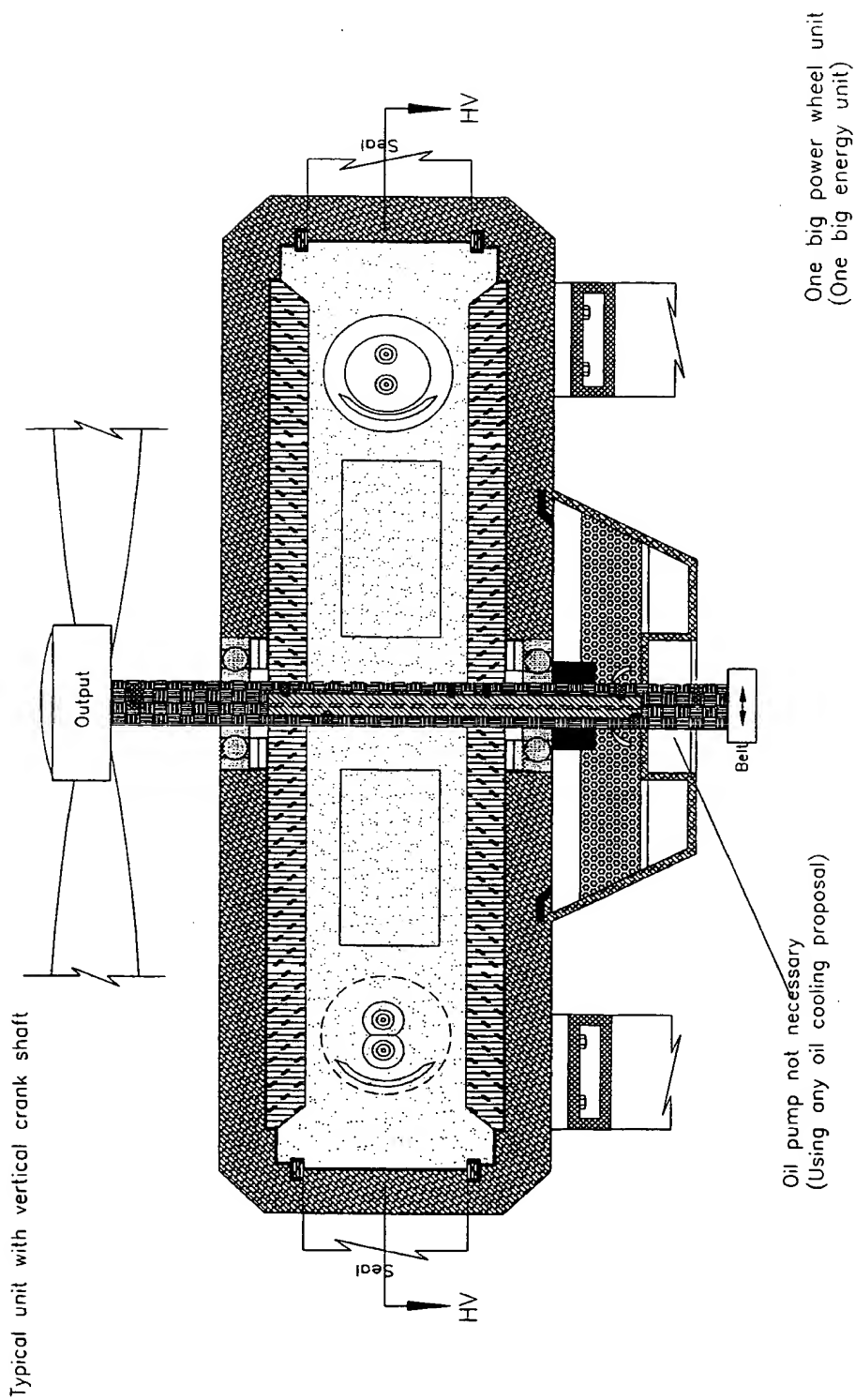
Super Power Wheel Unit
(Dual combustion ignition system or more)
Typical Section in vertical C. L.

Fig 23

Piston cup carve as specified

Typical unit with four pistons
Using dual ignition sysem
Section in horizontal C.L.
(for vertical crank shaft)
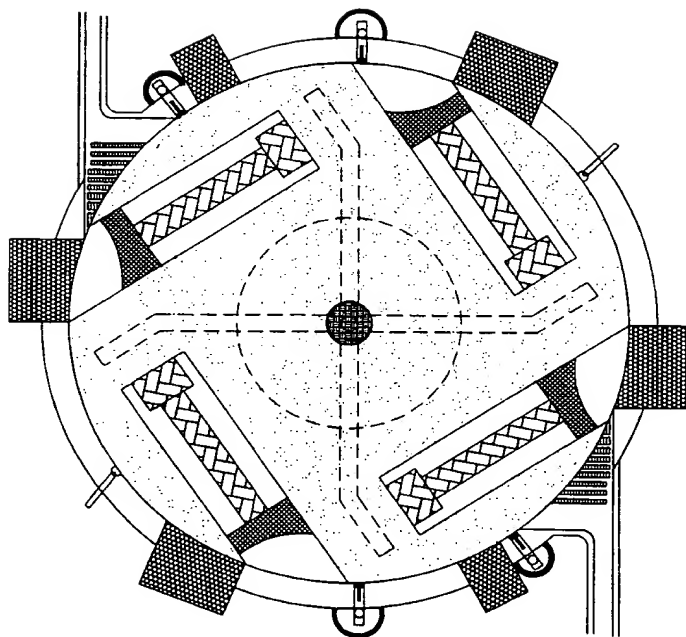
section HV – HV
A super Power Wheel Unit
(Dual combustion ignition system)

Fig 24
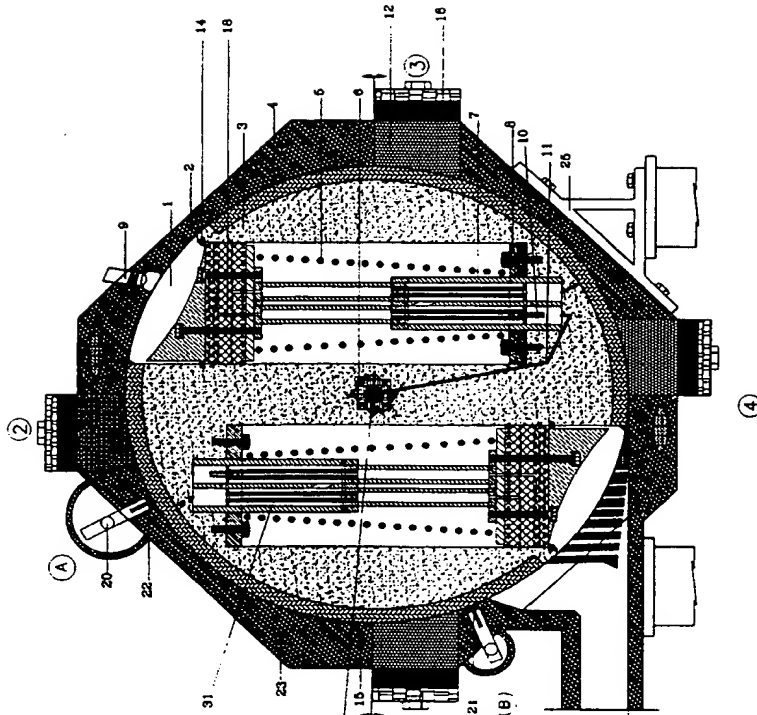
SECTION A – A

Section plan at vertical c. l. of power wheel
(A typical spring power modified)

Fig 25a
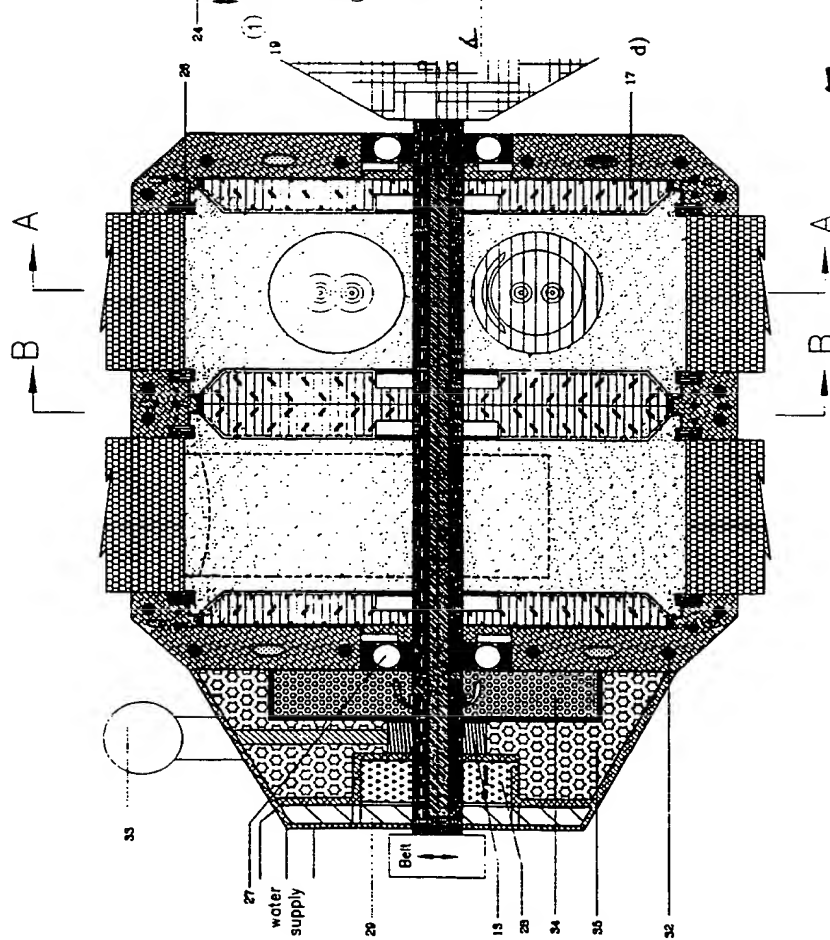
Fig 25b

TWO POWER WHEEL UNITS
Section plan at horizontal center line (sec. H–H)

water
supply

Belt

scale

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference SHIRWO S.	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/IB99/00178	International filing date *(day/month/year)* 29/01/1999	Priority date *(day/month/year)* 30/01/1998

International Patent Classification (IPC) or national classification and IPC
F02B75/00

Applicant

AL PASHA AL BAHDAINI, Shirwan

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of **67** sheets.

3. This report contains indications relating to the following items:

   I   ☒ Basis of the report
   II   ☐ Priority
   III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   IV   ☐ Lack of unity of invention
   V   ☐ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   VI   ☐ Certain documents cited
   VII ☐ Certain defects in the international application
   VIII ☐ Certain observations on the international application

Date of submission of the demand 30/08/1999	Date of completion of this report 1 0. 05. 00
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Yates, J Telephone No. +49 89 2399 2696

Form PCT/IPEA/409 (cover sheet) (January 1994)

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-35	as received on	06/03/2000	with letter of	02/03/2000

Claims, No.:

1,8 (part),9-32	as received on	06/04/2000	with letter of	03/04/2000
2-7,8 (part)	as received on	08/04/2000	with letter of	04/04/2000

Drawings, sheets:

1/25-25/25	as received on	25/09/1999	with letter of	23/09/1999

2. The amendments have resulted in the cancellation of:

- ☐ the description,   pages:
- ☐ the claims,   Nos.:
- ☐ the drawings,   sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

    see separate sheet

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

- ☒ the entire international application.

☐ claims Nos. .

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

INTERNATIONAL SEARCH REPORT

P. 1

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6   F02B75/26   F02B57/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6   F02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 252 764 A (COIGNARD) 20 June 1975 (1975-06-20)	1-10, 20-22, 27,29, 30,32
A	figures 1,2 page 2, line 14 - page 4, line 15	14-18, 23,24
X	FR 2 229 274 A (BOEUF PAUL) 6 December 1974 (1974-12-06) figure 1 page 1, line 1 - page 2, line 20	1-10,26, 31,32
A	US 4 127 096 A (TOWNSEND RAY T) 28 November 1978 (1978-11-28) figure 1 abstract column 6, line 16 - line 38	1,11,15, 19

-/--

| X | Further documents are listed in the continuation of box C. | | X | Patent family members are listed in annex. |

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 May 1999	13 0. 08. 99

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl Fax: (+31-70) 340-3016	WASSENAAR, G

3

		International Application No
		PCT/IB 99/00178

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	AU 59802 86 A (BULLMORE E A) 15 January 1987 (1987-01-15) figures 1-3 abstract claims 1-10	1,11,15, 30-32
A	NL 7 310 257 A (JOHANNES HALFHIDE PR BEATRIXHO) 28 January 1975 (1975-01-28) figures 1-3 claims 1-7	1-10
A	FR 2 086 778 A (LE DUIGO ROGER) 31 December 1971 (1971-12-31) figure 1 page 3, line 1 - line 35	1-10
A	FR 1 378 232 A (MINGUEZ) 22 February 1965 (1965-02-22) figure 1 abstract	1-10
A	US 4 009 695 A (ULE LOUIS A) 1 March 1977 (1977-03-01) figure 1 abstract	1,23,25, 26,28

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB 99/00178

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
FR 2252764	A	20-06-1975	NONE		
FR 2229274	A	06-12-1974	NONE		
US 4127096	A	28-11-1978	US 3967599 A		06-07-1976
			DE 2531564 A		05-02-1976
			JP 51033208 A		22-03-1976
AU 5980286	A	15-01-1987	AU 610054 B		16-05-1991
NL 7310257	A	28-01-1975	NONE		
FR 2086778	A	31-12-1971	NONE		
FR 1378232	A	22-02-1965	NONE		
US 4009695	A	01-03-1977	NONE		

Regarding Section I - Basis of Report

With the letter of 03.04.00 there was a page 32 of the description enclosed, but not referred to in the letter, which new page 32 seems to correspond to that filed with the letter of 02.03.00. It is therefore assumed that no amendment was intended.

Regarding Section III - No Opinion

Despite several differing versions being filed during the PCT procedure, the claims are not so formulated as to be able to clearly and unequivocally ascertain which features are essential to the invention and which are merely advantages or operating principles. Under these circumstances no meaningful examination for the criteria effecting patentability (e.g. Novelty and Inventive Activity) can be carried out.

- SHIRWO SYSTEM -*(Plant App. PCT/IB99/00178 - USP)*

(NEW INTERNAL COMBUSTION POWER SYSTEM)

INTRODUCTION

This is a brief research prescribing practical system for internal combustion engine provides better utility for fuel's energy by a design that could add more potential powers to engine output with perfect control for combustion intensities inside the engine to perform independently in harmonic effect, a system of different technologies associated in a simple economic discipline with wide options, to reduce the actual fuel consumption or to maximise the real potential fuel output.

It has been more than hundred years since that invention of Otto petrol internal combustion engine had appeared, still used until now to supply automotive powers. The fast progress in the world, the economical problems, the lack of energy, the increase of pollution on earth, make it necessary to develop more advanced automotive system, A compact engine that could convince the environmentalist organisations and the consumers ambitious to use a system depends on improved techniques to suit the computer age, in the main time providing methods to get use of those huge industries of regular weapons products, to be for civil efforts. Thus such advanced system in specifications, economic and has best utilisation for fuel energy with less pollution effect, is required to provide a promoting solution for the near future problems,*(referring to 'Kuoto' summit 1998 about industrial pollution).*

A new environment-friendly generation of clever combustion engines is about to be appeared, it depends on a solidarity of many scientific concepts, some defining natural events or has been used in atmospheric flying missions, even beyond it in the space away from earth's gravity; all inside this compact automotive discipline.

It was the inventor's dream ten-years ago to become true at the same time when an industrial community like US Gov. had appealed on 1995 to find more advanced automotive system for the future. This powerful system is flexible in operation and harmonic in performance, An automotive engine, that could become so close to Man's orders as much as close to alive object in work than just a machine.

This system utilises various scientific concepts participated in its missions of performance, it needs professional experts in I.C., automotive mechanics, hydraulics, aerodynamics and essential in physics knowledge, to be able to assess together the compound conclusions implied in the **criteria** of this power system.

Of course more diverse scientific researches in classified industrial laboratories would be needed later on for developing its various and wide options mathematically and practically (by using computer formatting). In order to reach the best commercial standards in using this system for different kinds of applications .

It's time to reconsider the way of using the potential energy of Petrol fuel in producing automotive energy for power engine equipment. In away to improve the energy of fuel combustion in engines, to make it in its maximum useful potential advantage to produce automotive power, by employing some natural universe concepts inside engine discipline, using advanced techniques depending on wide scientific knowledge to make these concepts employed under control inside the engine to be utilised to provide more output power for the fuel in the power engine.

Hopefully this could be a real useful automotive system to solve some future problems by a better way in utilising Petrol -God's generous gift to the mankind - the best powerful available cheap fuel material in the earth, in this economic design which is suitable for the future strict regulations and workable for computer age to fit the 21st century to be declared and invested for mankind peaceful purposes.

This research :

This brief research contains: description, design's principal (back ground), major changes, compositions & accessories, typical engine performance , conclusion of analysing potential ways of producing torque power, useful industrial & commercial characteristics, various design proposals, drawings contents, drawings(Figs) details , abstract and then the Claims, all on 46 pages with a set of 25 Drawings.
(Inventor personal wording prescribing most considerable sides of this invention.).

········· **DESCRIPTION** ·········

S-H-I-R-W-O :(SPHERECAL-SUSTAINED / HARMONIC-HYDRAULIC/ INDEPENDENT-

I.C. - INTENSITIES / ROTARY-REFLECTED-REACTION / WHEEL(S) / OPERATING)

S. : System : A SPECIFIC MECHANICAL DISCIPLINE TO MAKE THIS AUTOMOTIVE ENGINE WORKS TO PRODUCE TORQUE OUTPUT (FROM FUEL ENERGY).

A new internal combustion compact power engine in a discipline providing smooth sliding mechanism with flexible performance using the fuel potential chemical energy for internal combustion in relation with additional effects due to employing techniques of using Natural Physical dynamic forces inside the engine to provide better output from the said fuel, a system consisting many theories

working in association inside a simple mechanical discipline to utilise the maximum fuel energy for automotive power output, with minimum energy lost, in the meaning of reducing said fuel consumption related to weight-power ratio for engine output.

This system is designed to achieve the best mechanical way in transferring fuel combustion to automotive reaction, by using all known principles in one time with minimum power lost inside engine, moreover it provides ways to use physical effects which appear due to elements dynamics inside the engine to be utilised for its output benefit. This practical engineering design composing types of the recent combustion principles (those used separately to produce automotive power) the piston, rotary and turbine to perform all together as one compound system in this compact engine unit, and adding to it new principle of employing the inside physical dynamic reactions of engine's moving elements; all to provide maximum fuel utilisation in output. The system is a simple discipline using wheel(s) mounted on straight crank inside a case to rotate therein , the wheel(s) contains cylinder(s) for piston to move therein, the piston has a chamber defined as the space between piston top and the case internal wall with the cylinder bore surrounding the piston top, the piston is mounted inside the cylinder by free flexible push-arm connected it with cylinder base, to hold the piston and to transfer its flexible movement effects to the cylinder base then to the wheel containing it, with designed ways of isolating chambers, adapting services and conducting the parts in this discipline. This engine system produces torque power from Hydrocarbon combustion energy, by utilising the extension and pressure of emission gases after fuel combustion in closed chambers. In addition to that, this integral engine discipline will agitate and concentrate physical forces which appear inside the engine i.e. aerodynamic force of exhaust gases and physical dynamic effects of moving elements, to transfer these component forces as one resultant acting on the same target to apply more potential power to the combustion power of a said fuel. This system is designed in away to be flexible and harmonic in performance and could use any type of gasoline(octane)for fuel or Jet kerosene or even the gas fuel, dealing with fuel chemical energy in high efficient manner and adding to it - what could be said the indirect or invisible -inside physical powers(the resultant could be called the spherical sustained reaction). This system is using new technologies to arrange methods for employing natural physical concepts to be implemented inside the engine then invested practically for the benefit of the engine output .

THE PRINCIPAL OF THIS SYSTEM DESIGN (Back Ground) :

The conventional piston combustion engines depend on cylinder bank of pistons fixed in engine case (chassis) using reciprocated push-arm between pistons and a zeg-zag crank shaft connected with them in determined angles by mounting frictional minimising metal pads, transferring torque to the crank depending only on I. C. effect on pistons via push-arms in direct contact movement to produce power.

In fact those systems depend on fuel explosion but its effect should be always limited relatively with the constant piston displacement in cylinders -at all times - no matter how engine situation is, as their designs connecting all pistons with the crankshaft that is way their main problem is to provide precise ideal mixture control with its complications in order to keep equal displacements on all pistons always .

Those conventional engines depending on the direct reactions of fuel explosion-pressure power happened in the chambers only, depend on articulated mechanism neglecting other effect of physical forces that happen due to elements movements.

Although those engines have high rate of fuel power lost inside because of their machinery, appeared by the meaning of bad side-effects as friction, heat, vibration, noise ..etc. , causing a lost in part of fuel output in these engines, there is still no conventional engine design tries to concentrate physical dynamic forces happened inside automotive engine after fuel combustion to be used positively in its output.

This new design is seated in a discipline to use potential power of fuel combustion occurred inside pistons chambers as direct contact on its pistons with ability of flexible displacements (not constant displacement), to transfer any range of fuel power, beside employing natural physical concepts inside the engine by a design devolving its elements to agitate then deliberate these concepts, to have their effects acting consecutively positively to provide effective physical potential influenced forces to increase the final engine output.

The effective physical resultant power   (at a typical mod) due to reactions of :

1. Natural elastic characteristic of elements (elasticity of push-arm and gases).

2. Natural aerodynamic force of gases by the potential effect of exhaust gases.

3. Natural centrifugal potential power of rotating parts (appears at high speed).

This system arranging ways of utilising physical forces appeared consequently due to fuel chemical combustion energy inside this compact internal combustion engine, in the meaning of making these reactions working for the benefit of fuel

output, by concentrating the physical dynamic effects of inside elements movements instead of losing them as a lost energy inside the engine(as in conventional engines). This design is seated to employ and utilises natural physical concepts by making them appeared within the inside element movements in away to use the reactions as components acting positively in producing spherical effected resultant on the same target of fuel to apply additional torque on the straight crank of this engine, to magnify said fuel combustion power in output, in relations to the engine design and/or speed and load situations. This new compound concept is working in association with the fuel combustion inside this integral mechanism engine with its easily controlling ways; will increase the said fuel output or reduces said fuel consumption for any application.

The system mechanism will transfer all physical powers occurred inside engine to a kind of spherical resultant added to fuel combustion which already will be transferred to produce final torque output inside this system in a way keeping minimum energy (i.e. combustion power) lost inside this engine due to it's simple machinery (recent systems have loss rate of 15-40% due to their machinery as friction, heat & noise) which will be affected on the power-weight ratio in out put . This system is dealing with almost total potential fuel combustion's energy to be transferred to torque power, in a discipline providing perfect adiabatic efficiency .

The system is investing speed as a physical factor to reduce its fuel consumption.

The main seen achievement on this power system was in existing independent power units in a flexible engine that any part could bear different ranges of fuel power or even stop without disturbing the engine mechanical efficiency keeping harmonic performance with its ability to have automatic control for engine parts.

This is a **system of** any piston (or group) can work independently maintaining smooth engine performance without disturbing its efficiency to be as **auto-power** engine unit for various applications. a system utilising the inside-engine potential physical powers for the benefit of engine output and could counter said fuel consumption in highly speed. The conclusions on this system would observe many good characteristics such like: better output performance, less fuel consumption, automatic power, a built-in pollution treatment, computer control for the engine activities, the long duration for easy maintenance with variety of design proposals, All these could be found in this simple fabricated compact engine system.

MAJOR CHANGES (IN TECHNIQUES) :

The techniques in this principal totally differ from those used in the conventional systems (Otto, Diesel, Wangle and those with modified DOHC, SOHC or even Turbine or Jet system). The main change is in the participation of the systems of piston, rotary, turbine with the novel principle of utilising the benefit of physical effects inside the engine, to perform all together in association, to produce a better output and/or to increase the fuel efficiency in a compact engine. The changes are:

A system of various power stroke, one or two or three or more piston power strokes as required (on the same part of crank) at one crank rotation, no energy loss stroke for all pistons displacements i.e. all react positively on engine output .

A system using straight crank shaft and wheel(s) mounted on it contains piston(s).

A system of independent piston performance related to crank or other pistons.

A system of free flexible (elastic) piston push-arm to transfer potential energy .

A system using pre-compressed air-fuel mixture to be boosted it to a spark engine.

A system composing piston & rotary & turbine performances inside one engine.

A system that employs & utilises Natural Physical concepts forces in its output .

A system utilising aerodynamic power of exhaust gases to act as a turbine output .

A system that could reduce the high fuel consumption; due to the speed increase .

A system of less fuel combustion energy loss due its simple sliding machinery .

A better fuel combusting in all engine situations using flexible-space of chambers .

A system could be used in horizontal or vertical way relatively to the torque shaft .

A system treating pollutant in a practical way with a built-in techniques in engine .

A system bears different power ranges in harmonic performance for various speed.

A system leads to set automatic-parts performances as auto-output engine unit .

A system of discipline provides high adiabatic efficiency inside automotive engine.

A system of efficient conducting for its activities to be suitable for computer age.

The pioneer characteristics of this system could be concluded and practically approved by analysing the main scientific concepts implied inside, which are in :

I. C. , dynamics, hydraulics, aerodynamics, physical concepts, powers analysis, metals technology and pollution treatment, these sophisticated subjects are associated in the performance of this system which required various mathematical equations more than those used in the regular systems, to achieve the required criteria for each option on this compound but easily fabricated automotive system.

THE MECHANICAL COMPOSITIONS & ACCESSORIES OF THIS DISCIPLINE

Compositions as per the enclosure typical drawings of :-

An Engine of three wheel units -of 2 pistons in each wheel using Gasoline :

1./   Out side Case (the engine body chassis) a metal cylindrical or octagonal shape (or as the drawings) with a diameter of 330-380 mm in horizontal-position on crank and approx. length (in drawings) of 550-650 mm has a large cylindrical cavity of 301 mm. Contains trenches for seals, tunnels for oil, water and places for valves with special exhaust opening, design & assembling requirements may divide it in parts upper and lower or more, and could permit to cast it in two layers of different alloys with trench's & tunnels.(Det. 2 , Fig : 2/25 &, 3/25, 4/25)

2./ The crank (as main crank shaft) a torque output shaft is a straight solid steel iron, placed on the horizontal central line of the engine along the Case length and extended more, its diameter 25 mm-50 mm .The connecting points with the Case by ball bearings, which allow it to rotate only on its centre line. It contains central oil tunnel in its centre line, contains holes for linking oil feeding the rotating parts. Its surface geared (grooved) to interlock, trinket with the rotating parts to move coinciding all together as one system. (Det. 6, Fig : 2/25 & 4/25)

3./ Power wheel unit (flywheel unit) a metal wheel (3 in the drawings) is a solid strong light alloy wheel, a diameter of 300 mm and a width of 100-120 mm with circular circumference strengthen by scratch-resistant alloy, contains (here) two cylinders(for piston) with outwardly opening placed in centre-side in opposite direction perpendicular to the centre axis, each with smooth internal surface bore and diameter (here) 80 mm and length of 120-180 mm depending on the industrial requirement data. A piston placed to move in each cylinder adapted with its base, that has two small oil stores (sumps) one in which receives oil by tunnel linked with central supply tunnel (canal) in crank for intake oil store to feed piston via piston-arm. Other for outlet oil store receives oil via piston-arm then to dispose it by a tunnel into wheel side. The feeding intake oil store kept in a full mod always, if required by specific hole with outlet oil store. A hole the centre of the wheel to gear -interlock within Crank (torque output shaft). There are two washers around the crank on the two sides of each wheel for oil lock. There are two edge trenches in the circular circumference face of the wheel for fixing a pair of two sides circular wheel gas-oil-slider seals. The number of these

wheels the diameter and cylinders depend on the design and output ability of the engine applications. The direction of the cylinders centre line in a wheel differs from a nearby other wheel's cylinder in a known angle that could be found from dividing 360° by the numbers of the total cylinders in performance for the engine. The crank may be geared with wheel according to the wheel numbers for easily angler assembling that starts with all rotating parts in the relevant required angles then ball bearings particularly i.e. all rotating parts to be geared on the crank, by pressing them exactly at the designed angles before fixing the crank in the Case position. The manufacturing of power wheels units would be done by casting alloys with modified geared hole to interlock with crank, drilling oil tunnels, trenched on edges, a smoothing circumference and cylinders bore for pistons these with Case tunnels design would be the standard mass production lines for any engine proposal . (Det. 3, 41 Fig 2/25 & 5/25)

4./ The pistons: each one is from high resistant light disk of solid metal alloy, fixed inside the cylinder with 20-35 mm thickness nearly the same cylinder bore. It contains grooves on its circular wall for seals of gas and oil. There are two middle tunnels oil inlet and outlet inside suitable in linking the build-in oil pump on push-arm device from top end with piston, other smaller radial tunnels linked separately with each of these two middle tunnel horizontally to piston circular edge (to oil gap)to cool piston and to distribute oil to piston wall contacting cylinder wall. A special lubricating seal or two in the oil gap on piston wall to uniform the lubrication on piston circumference wall with cylinder wall, for good slipping movement, minimising friction and heat for the main anti gas and oil seals while piston in movement. The piston is connected by washer-bolts with its solid bearing base plate that capping the flexible push-arm beneath piston. A solid steel ring at the top of the cylinder wall fixed in a groove to lock the piston in the cylinder if required, A suitable curved top capping piston face is required to provide a suitable chamber shape, manufacturing of piston by costing alloy with designed tunnels, grooves and seals ..etc. (Det. 7, 41,42 Fig 4/25 & 8/25).

5./ The flexible piston push-arm is two pair of stainless steel pipes slipping inside each other (or 1 pair) fixed vertically on cylinder base inside its bore by two washer-bolts. A metal spring (straight or inclined) around or a built-in with the push-arm body, is reinforcing it, the push-arm job is to maintain a linear

piston's movement, it is designed to work freely as an elastic resistance for a certain required reactions (capacity) for each proposal depending on engine data, it connects the piston and wheel at the cylinder base for linear variable designed displacement distances inside the cylinder cavity, without being guided or guarded by essential mechanical cam shaft in the engine, also it could be of liquid hydraulic device working as elastic resistance i.e. similar to the devices used in automatic re-fill weapons as fast guns ,(Det. 8, Fig 4/25, 8/25 & 11/25).

6./   The oil pump for piston,(piston's private oil pump) is made from a sliding pair of pipes each of small stainless steel pipes slides in each other contains inside tunnel for oil, consists one way oil valve (check valve) in each inlet, or in opposite direction (a valve, using solid small ball locked in a longer size chamber of a curved end as a shape of the ball's half spherical shape with a smaller opening and other opening of many small holes to let the oil flows in one direction according to piston movement).To act as simple rod (shaft) pump due to the piston movement (with push-arm),sucking oil from the main oil canal in Crank via the inlet oil sump in the cylinder base, supplying oil to the piston then disposes it to wheel side-wall. A pump of two pair with opposite flow mounted inside the same push-arm device as in the drawings.(Det. 10, Fig 4/25 & 8/25).

7./ The cooling & oil pads: each one is of light alloy plate of 10-30 mm thickness circular shape geared with the Crank attaching each wheel side-wall has radial trenches, (i.e. grooves) facing the wheel side wall, starting from central zone(pad sump) to the edge outwardly, coincided on wheel has about the same diameter and to act as a centrifugal pump (turbine), an inlet hole in the central linking oil from crank central canal via crank outlet which coincided with to feed oil to pad, then oil is distributed via grooves on wheel walls ,cooling wheel side-walls then disposed to the circular edge then to outsider at top portion of Case to oil service tunnels, (an air opening in ceiling of main oil tank is provided), the pad contains at its last circular modified smooth edge, lower (or higher) zone(s) in certain places against its relevant chambers, for controlling the mechanism of slipping bar timing mechanism for the engine feeding valves as rotates with the crank against the chambers in the right time, kept moisturised by oil always, providing independent mechanism feeding for each wheel. The other duty of the pads to provide adiabatic efficiency for engine,(Det. 17, Fig: 3/25 & 7/25).

8./ The radian seal masses (anti-gas), fixed in the Case: each from metal alloy (or hard anti-heat plastic or carbon combination) designed according to its work, which is the anti-gas seal attached the wheel wide circumference face in coaxial to the Case. The principle of these radian seals by contacting wheel circumference and keep on sliding on it attaching the two circular wheel edge seals (the Case part) at wheel sides to provide a closed situation for any chamber in that portion to keep constant mod (stroke) in that chamber independently for each wheel i.e. preventing gases of chamber from penetrating while its wheel rotating. A right depth fixed from outside on the case by a special locked washer and each could be adjustable for contacting (attachment) with the face of wheel by a mechanical control spring regulator or (automatic thermal regulator). For a metal alloy it could be designed in a special way using linear metal seals, fixed on a base to provide a mass of seal in that portion, with various technique methods of oil services using the advantage of a one way rotation of the wheels and oil discharge keeping on flow in the Case during engine work. (Fig 20/25) .

A relation with rotating direction and existing of special small inclined trenches on the wheel surface in the right places (or on attached pin-mass unite) with automatic opening for oil inlet and outlet holes. This could be applied with timing pins in the rotating parts. Using the advantage of one way rotation monitoring oil discharge from Case (or on wheel side phase) starting before entrance of the seal and disposes, while wheel rotates at a duration enough to lubricate attached zone particularly. This could be guarded with spring solid balls in specific place with each mass with a timing system controlled by edge of one side pad of each wheel,(or the wheel it self) . Another way by applying holes in the circular anti-gas seal system, the special timing controlled opening system depends on one way rotation, using circular interlocked parts with holes at these seals. There are special holes on each blade ring that opened across as one hole when seal blades meeting all in one fixed point(s) to set across opening hole for oil feeder from Case to these seal masses at required places. The direction of rotation and trenches in zone of wheel surface will collect the oil drops rapidly to the inlet holes (automatically opened) by specific techniques on the circular seals which fixed on the wheel edges before gases attend to reach

the seal mass, from the coming chamber and before even the chamber reaches the seal position, maintaining surface in a good slipper. However the gases pressure direction may be used to dispose the oil in the right time. **The number** of these seals 3 to 4 for each ignition duration and the radian distance between each one is less than the net radian distance between wheel chambers as the distance of specified attached surface, in any way providing various lubrication technique depending on the expert of industrial laboratories.

The working principle of these seals in their designed positions around the wheel is to maintain and to transport the locked-closed situation of chamber(s) i.e. keeping same status of mod in chamber ; while the wheel in rotation.

These seal masses are in three types of jobs (to work in relative to) :

No, 1 for one way anti-gas of air-fuel mixture; before starting the feeding operation on chamber and the place directly after pure air-valve in the Case.

No, 2 for two sides anti-gas, a side for the zone of charging air-fuel mixture, other side for gases of chamber after combustion, a place before power stroke.

No, 3 for anti-gas of the combustion gases at a place before exhaust stroke starting penetration from exhaust opening with particular specification .

The **essential radian distances between seal masses shown in (Fig -10/25)** The size of any seal mass could be designed on bigger bas in order to allow a piston's maintenance preparation from the Case via this opening ,i.e. without open the engine Case to simplify any piston maintenance and push-arm device (also seal No, 3 could be repeated), (Det. 19, Fig 4/25 & 5/25 & 10/25 & 20/25).

9./ The circular anti-gas seals(wheel-case-slider, seals) on the two side's edge of each wheel's circumference, designed as required, a suggestion of suitable two or three stainless steel blade rings mass fixed in specific grooves in the wheel and/or with a part fixed in Case and other in the wheel. To interlock together when fixing all parts of the engine, as separate pair of ring pieces fixed in Case, other ring fixed on operating wheel. The seals components would form together a tighten and a sliding device to protect the chambers from any penetration of combustion gases (and maintaining the required closed chamber for all mod of mixture). They could be lubricated with special holes in the right place where is no longer pressure on it, (i.e. end of exhaust opening) or using a self-lubrication seals or as industrial design , (Det. 26, Fig 2/25 & 3/25).

10./ The usual oil pump (and subsidiaries) , which is fixed in the front end of engine (or else). Connected with the crank to transfer oil from lower store oil tank , that receives oil flow coming from Case end, to the upper(middle) oil tank which discharges the intake of the main tunnel in the central crank. In which it has its winging (impeller) parts, in a shape that could direct the flow of oil sucked by tunnel's inlet holes in crank which suck it when rotates to discharge it to pads or pistons in each wheel by relevant holes outlets depending on the Centrifugal concept for each part. These outlets holes to the engine parts in the crank are in a specific design for their opening diameter depending on its relevant distance from main oil supply (Det. 24, 28 Fig 2a/20). The trenches in each pad i.e. grooves will be filled with oil, feeding from Crank holes flowing due to engine crank ration directed outwardly from centre. By centrifugal energy depending on parts-diameter due to its rotation. The grooves in a way contacting side-walls around each power wheel unit, for cooling as for Adiabatic. To provide perfect enthalpy system for each power wheel unit. The oil flow will reduce the heat of cylinders after fuel combustion. The pistons get their lubrication oil with the same principle, from a small tank (sump) in the base of each cylinder as intake store. That will be refilled always (if required by specific opening between the inlet and outlet stores with excess length of its intake rod pump tunnel). The demand of lubrication oil for each piston will be supplied as its movement need. The piston will take sufficient lubrication oil by its lubrication pump fixed in its push-arm that sucks oil with any little movement ,supplying the piston needs. Then flowing and directed out side piston by out flow tunnel to outlet sump ,then far from wheel centre to wheel side wall .Then disposes it in the pad zone to be directed to Case by the same Centrifugal concept. The oil grooves and outlets for each pad to the Case as per the design. (Det. 10,11,15,17,28 Fig 2/25,3/25).

11./ The valves of air-fuel mixture and pure-air, air pipe-valves: are of same similar shape with mechanical control on the case, each is in a separated short pipe device contains valve of a triangular with a wide back opposite to the air pressure supply direction. A triangular or curved shape against each wheel circumference in the case opposite to a same smaller graded shape opening. It is guarded by a spring. The place is in Case wall in a sufficient distance before firing zone for feeding chambers directed at central of the wheel circumference

surface and to be opened at the right time against the chambers. They are controlled by the rotation of cooling pad(s) in a side of each power wheel. A simple mechanical elastic rod system connected within the cooling pad modified edge. There is a small smooth roller on rod end that (which is oil saturated) attaching the pad differential edge for timing the opening. By the meaning of lower (or upper) zones on the pad edge using this mechanism to transport and controls the opening movement to valves. (Det. 20,21,22, Fig 4/25 & 7/25).

The air-fuel mixture valve is to supply and feeding the air-fuel mix to a chamber. The pure-air valve is to puff the air to a chamber while still opened for cooling and expelling the exhaust gases from chamber for air exchanging mission.

The two valves in each wheel boosted consecutively with pressured air by one device into their pipes from the same resource i.e. pressured air cylinder or centrifugal compressor or turbine powered by engine rotation as it needs.

The principle of distributing the air between the two pipes for chambers, its differential angles (i.e. different timing), maintaining the required pressure for both air-fuel mixture and puffing on a chamber(or adjusted) at various speeds. The controlling requirement done by using outlet opening regulator of pressure release for main air supply(i.e. a reducing of that opening in higher speed means more pressure to engine) by using this before air enters the two pipes. The fuel will be splashed at exact mixture or various rate (as required) on the pre-compressed air directed to chambers to supply the chambers with fuel mixture before firing it inside chambers in fire strokes.

The fuel splashed could be done by a simple spraying device of a needle valve(s) or a simple sub- carburettor or by mechanical or electrical computerised system as indirect injection as pre-mixed air-fuel mixture in feeding engine or in sub-store for each chamber (or direct injection at feeding zone on the wheel).

12./ The ball-bearings fixed in engine Case for holding the Crank by connecting it with Case from two end sides or more . (Det. 27 Fig 2/25 & 3/25).

13./ Water pump is as known in the front side of engine (or out of engine) with its outer radiator and pipes, with Case water cooling system tunnels (canals) to cool the returning hot oil and all engine Case. (Det. 23 Fig 2/25, 3/25) .

The air cooling system could be used instead of water with required tunnels or wings on the Case reinforced by air turbine to discharge air towards the Case.

14./ The exhaust opening is in the Case for each wheel : starting with a small graded increasing in opening with direction of rotation in a special aerodynamic angles ,meaning specific wings designed in the outlet of exhaust pipe in order to make the escaped gases at exhaust stroke take penetration position in a perfect way to produce a potential aerodynamic reaction on the wheel to act on the same direction of rotation depending on escaping balloon concept on chambers. The principle used here is to reverse the flying principle which utilising the fast air produced by plane fan to produce fast air turbulence on the air-plane wings to fly. In this design an assumption of a fixed fan (the exhaust specific opening) will be under fast air reaction(the exhaust gases, under its pressure and due to piston elastic depressed push-arm). The wheel is free to move (as air plane) i.e. wheel will be under reaction of an excess potential power to be rotated, assuming Case moved in relation to wheel put really the wheel moves, in reversing situation. This specific opening connected strongly with the case and exhaust pipe for each wheel then connected with the main exhaust pipe and could be moveable mechanically for changing its specification and angle depending on various calculations of engine data. (Det. 30,   Fig 4/25).

15./ Ignition distributor as known, put any contact point has two contact points against each other for each wheel on the circular distributor, as the number of pistons in each power wheel units (depends on piston/cylinder No i.e. a triple in equal angle if a wheel has three cylinders and so on) . Using the same angle distribution for the pistons in whole wheels each one connected by one cable to its spark plug. The rotating conductor could be (here) faced each contact point twice per one cycle to spark two chambers every one cycle. (Det. 33   Fig 3/25).

The ignition distributor could be placed and mounted in a suitable place to rotate by pinion device with the required relation of engine Crank rotation.

For engine of one large wheel with many pistons (cylinders), by using usual one contact point, with the same angle distribution, using one cable for each plug as two for dual ignition and so on , and could be used easily.

16./ The accessories & sub devices :

A cylinder stores relative compressed air with a compressor pump for recharging working with the engine rotation by a belt, to feed the engine with pre-compressed air. If a compressor in a vehicle could pump its tyre with the

required pressure, why not using this method to charge pre-compressed mixture to this advanced compact engine !. A centrifugal turbine fan connected directly with Crank could be used to supply the pressured air to this cylinder. This **cylinder** should has a sufficient air pressure before the first engine performance. The charging air supplement to both air-fuel mix and pure air for the chambers, the types of air temperature could be controlled. A mechanical and/or electrical controlling device for air pressure, connected with the accelerator pedal of the driver cabin. A modified turbo charger may be used instead which is depending on pre-heated and compressed by exhaust gases speed and heat but it may be not working in the same perfect efficiency for this system which needs pre-compressed mixture.

The fuel spray injection device instrument to splash it in the compressed air using the simple natural spray principle on a liquid (i.e. the acclimatisation), depending on volatile of the opening and the specific density of fuel. This is the indirect injection way of engine charging of air while still in its way to chambers. Maintaining idle (very slow engine workability) by electric needle valves works with ignition by electric device. In this way any kind of fuel octane could be used since the flexible push-arms are used also. A mechanical or electrical device system, can be used as one unit for all chambers requirements since it is using same air pressure controlled by a simple accelerator pedal from driver cabin .

A separate pipe-opening regulator for fuel-mix valves in each wheel unit requirement, is in using the controlling system for automatic engine(or using independent fuel injection on supplying pipe or a store in each feeding valve),

(or using direct chamber fuel injection with its device for each wheel, fixed in the case ,as this could be more complicated devices connecting on the case).

The charging air could be pre-heated using a device with electrical heater or utilising the exhaust emission heat by attached device within the exhaust pipes.

The charging compressed air pipes should bear the maximum required pressure for engine application with a safety factor. (Fig 21/25 & 22/25 & 23/25)

17./ The assembling method (compositions set up) is starting with the main crank mounting on its all ready wheels and their pads by pressed together on it as the required angles. Placing other parts and required circular seals on the wheels and fix them in the grooves of Case parts then coming other accessories.

THE ENGINE OUTPUT POWER TYPICAL PERFORMANCE

As for (Fig 4/25, 5/25, 6/25, 7/25, 8/25 , 9/25 ,10 /25 and Fig 18/25) .

1. The engine starts to rotate by a starter motor-accessory fixed near an end side of the engine, by a starter switch for few seconds

2. All the inside parts will rotate, the valves start the work due to the automatic system of controlling the opening a giants each chamber in power unit wheels. Feeding the air-fuel mix, controlled by accelerator of driver pedal and its (idle) working feeding or a bit more ; to the certain chamber by opening its valve at the exact time with the programmed mechanism by its pad via connected taping bar, the air-fuel mix is compressed in chamber i.e. space over a piston, the continues rotation will make this chamber at a place opposite the spark plug. .(a comparison with Otto system !)

   (as suction stroke) ... piston moves downward .... in (Otto system).

   {fuel feeding-charging zone }... piston still without move here ....in (Shirwo S.) .

3. The chamber will be filled with pr-compressed air-fuel mix. that maintains in pressured situation since the chamber locked by Case wall and piston and radian seal-masses from two sides contacting circular wheel circumference coaxial with Case cavity, as designed radian position of seal masses for each wheel contacting its circular circumference will keep chambers mod in the required closed situation .

   When the chamber reaches the spark plug .The air-fuel mix sparks instantaneously by ignition timing distributor. It will explode to a large volume of gases then put off. A produced gases which need to expand to their natural large volume, but they are in closed chamber, causing high pressure power on surrounded walls and piston. Piston has the flexibility of start moving to be depressed inwardly due to its elastic push-arm connected beneath, to cylinder base, causing stress on this spring in the best typical way due to gasses pressure on piston then depressing it then charging energy to this elastic push-arm, (the following missions will happen rapidly).

   (firing stroke), piston moves downward, Enthalpy, starting power stroke (Otto).

   {firing stroke}, piston moves inward , Enthalpy , starting power stroke (Shirwo S.).

   When the piston depresses inwardly, the elastic push-arm will transfer a part of this stress to the cylinder base (wheel side), causing rotation of the wheel, depending on its capacity, the rest of this stress on spring will be stored as constant pressure with charged resistance of the piston push-arm to be used later on aerodynamic reaction of exhaust gases (this is one duty of the elastic push-arm here).

4. As part of reaction caused by push-arm acts on cylinder base on wheel centre-side will push the wheel to rotate by piston displacement as moves inwardly due to combustion gases emission keeping a constant pressure in the chamber, ,

(power stroke) piston moves to constant displacement ...high Enthalpy (Otto)

{ power stroke -1st power zone)piston in variable dsplt., high Enthalpy, (Shirwo S.).

Since firing stork is happened and finished when explosion is previously burned all the air-fuel mix and has put off rapidly keeping chamber(s) extent space stand still in high constant pressure without flame before reaching the last exhaust seal mass.

5. Due to this rotation of the wheel, the chamber will cross exhaust seal reaches the opening of enlarging trenches which graded in the same rotation direction. The emission left gases which still in high pressure inside the chamber (as the piston is in depressed situation i.e. inward situation), will cause additional power effect on its wheel due to the rapid escaping of these gases from the chamber via exhaust pipe.

* (exhaust stroke-end power stroke)piston moves up, Enthalpy,.. power loss,(Otto.)*

{exhaust stroke-2nd power zone} piston release, Enthalpy, ..exhaust power, (S. S.)

6. The additional stresses (invisible or indirect) which act positively on wheel are :

1st the stored energy of spring (resistance) will attempt to be free causing power on gases (against piston) in chamber and due to circular Case inside-wall (chamber back-wall), and the uniform pressured gas physical characteristic of chamber gas pad (still closed chamber while moving along circular wheel edge zone) that will counters the reaction; this potential force will be reacted positively on piston direction which will provide simultaneously additional continuity power to keep on rotating the wheel in the same direction .

2nd at the time of gases start to penetrate from the graded exhaust opening and due to start losing of gases pressure in a chamber the present compressed elastic push-arm (for piston) which has been already charged inwardly due to fuel explosion in chamber before; will start rapidly to return to it's first position (normal situation) pushing the piston outwardly again, that will push also the remaining gases still not manage to totally penetrate to escape faster, this will cause potential reactions on the wheel by the elastic push-arm reaction to get its release situation , reacts in two direction i.e. on cylinder base means on the wheel and on outwardly piston, (to form additional reaction to rotate the wheel).

3rd the locked pressured gases which reach the exhaust zone, start to penetrate via exhaust graded opening and will be discharged fast causing Aerodynamic force to drive the chamber (i.e. cylinder) in a place that all gases manage to escape rapidly as escaping balloon concept (the flying concept in reveres way e.g. exhaust opening has wings seated in specific effective design and direction), which acts with more reaction on wheel (additional reaction). So :

(upward d. pt.)high Enthalpy, entropy by Body cooler only, power loss ...... (Otto.)
{release piston}, control Enthalpy degree, entropy by Air puffing & Body cooler more effective reaction on power .... (Shirwo S.).

A summation of stresses will effect on the wheel. and on this a semi-opened position, stresses effect on these parts or near by will be less since the explosion of the air-fuel mix has already finished before in the chamber alone far from any valve. Same operation will be happened with the nearest wheel chamber (by angle radian distance) consecutively and so on the rotation movement will continue.

7. When the gases manage to escape with the rotation of the wheel, the chamber will reach at the end of the exhaust opening to the pure air puffing valve that opens due to the rotation and tapping of timing bar controlled by side pad against the chamber, to puff a fast pure air, cleaning (scavenging) the chamber from what left of the gases as exchanging operation (the emission by pure air) .To expel these gases before the chamber leaves the exhaust opening totally .This helps in ending the expected tacking due to the remaining carbon optical which may exist after burning the fuel mix .This way of cleaning the chamber by air has a great effect in deducing the pollution of un-oxidised gases. It is helping to treat them while still hot and will minimise the expected production of harmful premier oxide gases. The pressure of this air will exceed while rotation speed increase with adjustment to keep chamber always in a suitable temperature for engine situation by this new procedure .

(suction stroke) piston to downward d. pt. high Enthalpy, stroke& power lost (Otto.)
{natural stage – air puffing on chamber} control of Enthalpy no power loss (S. S.)

8. Then the rotation continues for the next stage to be for the comparison :

*(compression stroke) piston to upward dead pt., Enthalpy, loss power, old S.
(feeding -charging zone) control of Enthalpy, no power lose, ... Shirwo engine.

9. In increasing the speed of this system, the radian rotation velocity of the wheel would become near to equalise a speed of pistons push-arm depression's velocity

(resistance speed reaction),it is theoretical assumption depending on character data of this elastic push-arm, although the high speed will try to balance the wheel

This means the expanding spaces of chambers will be deduced (for the said engine power) by increasing certain speed, a mathematical criteria with fuel feeding rate: speed, resistant depress, dimensions, fuel and of course the loading on the engine will be concluded to reduce fuel feeding at increasing engine speed.

In high speed also, the reaction of the nature's centrifugal power will appear at combustion stage then power zone to act on piston(s)(and its chambers) consecutively as located almost in circumference of a rotating circle, free to be pushed outwardly, by this centrifugal potential opposite power (i.e. piston and combustion gases in the chamber, as mass reaction under Newton law), but due to gas pad in a locket chamber (after combustion happened), and existence of Case circular back wall (chamber back wall); that keeping the chamber in constant radian move maintaining the same constant pressure in the chamber (due to this design and seal places).This pressured gases as gas physical characteristic will reflect as a balloon any power effect on it as opposite reaction of piston to counter it back again on piston(s) , then wheel(s) magnifying fuel combustion reaction on engine. It is meaning of reducing the expanding of chamber in highly speed for the said power, means reducing of engine fuel requirement for the said speed i.e. a criteria for reducing fuel consumption while increasing speed. (Fig 19/25).

The accessories which help this engine to work are:

As shown in (Fig. 21/25 & Fig. 22/25),

A.   Cylinder for compressed air, this cylinder should be in a suitable air pressure by the manufacturer before engine start to performance only, then it will be charged automatically by the engine via a compressor which gets its rotation power from the engine itself by a belt which keeps the air in sufficient pressure. It is to discharge air to the main pipe which guarded by a regulator controlled by accelerator-bar from driving cabin which is always in closed status when engine out of work, electrically. To be opened when ignition starting with the slowly-run (idle) regulator. A device control the pipes outlets one for (air-fuel mix) to get fuel spray for whole power wheel units .Or to a separated fuel spray system for each power wheel unit, by electric control (computer system) from the driver cabin. The other pipe for pure air to be puffed on piston and its chambers at end its exhaust.

B.   The fuel spray system is a mechanical and/or electrical device with a needle valve which uses a simple principle of permitting fast air passing on small outlet opening of fuel to produce spray in this air as required depending on Specific Density of fuel which maintains in supplied by usual fuel pump(mech. or elect.).

C.   The necessary pressured air will increase due to driver paddle-managing system controlling feeding then speed of engine's rotation and torque power.

D.   The other accessories like oil pump and water pump and ignition distributor will rotate with the crank or as for the industrial design.

The overall work of power wheel units (as all) output with a remarkable rotation speed monitoring the ideal output of this engine could be changed not only by depending on increasing fuel discharge-pressure, it could depend also on other engine modifications for separating engine's part performance as auto-output.

CONCLUSION , of analysing additional potential energies :

The maximum fuel power output that occurs due to a larger and longer pistons moment on the Crank, larger than recent existing systems, with the effective angle of torque power (could be more than 180 ° -depending on the design).

After the instance of fuel combustion in this mechanical design and according to the direct powers occur simultaneously at fuel combustion in this discipline which employed natural physical concept powers to happen due to the particular places of chambers and by utilisation physical characteristic advantage of gases under pressure in chambers those result due to fuel combustion, reactions appeared as:

1.   The pressured gases impact on piston, the power reaction of elastic flexible push-arm, would act on two ways. A part pressing the wheel to rotate, and a part acts to get back to its previous mod at the piston top point (upward dead point), as it is elastic push-arm that will be stayed in charge beneath the piston, due to chamber's combustion gases. It is the gas physical characteristic in a closed space, which will resist any force as gas elastic resistance to reveres (reflect) this reaction appositely, which will be back again on piston and since the back side of chamber is the Case circular wall (internal circumference of circular case cavity), which provides away for keeping it moving smoothly (on constant fixed axis), keeping chambers in locket situation by the radian seals job, while the wheel rotates means keeping a lock chamber in power zone with constant pressure. This means keeping the longer impact effect of this power on Crank. This is the

hydraulic reactions of chamber gases inside this engine & the spherical shape advantage in utilising the chamber pressured gas pad characteristics in this situation by consecutive investing of all physical powers effects happen inside this system to be concentrated on the chambers to be used positively on engine.

2.   A losing of pressure due to gases penetration as gases start to penetrate when wheel chamber reaches the exhaust opening, will agitate the elastic charged piston push-arm (in static situation but depressed situation) attending to return back rapidly to its normal position, it reacts on two opposite directions (two sides), meaning on wheel and chamber gases to add more power on wheel for torque.

3.   After the continuity of wheel movement and those powers effect, a new physical power happens after this instance due to the way of exhaust wings opening's design. That allows the under-pressured gases to extend partially then totally penetrating in away to get their fast best position of escaping from chamber. With the advantage of existing access power from the piston push-arm resistant being under press that attend to return to its normal (first) position. A Physical power which is the Aerodynamic that forces the chamber to be at the right directed portion while gases escaping. Which will cause additional rotating power on the cylinder i.e. wheel to rotate depending on its place and on the exhaust opening place in this design. By the meaning of escaping balloon principle used here in this analysis. It produces aerodynamic power by using the effect of air speed concept (as flying concept put in a reverse way of reaction analysis).

4.   In increasing of the engine speed (i.e. revolution speed) physical powers will appear, instantaneously at the time of combustion and increased consecutively, with influences on the piston (chambers) performance and will effect in two ways. First , each piston which produces linear force to accelerate a revolution of a circular mass (the wheel), which is mounted therein. This will be under a physical effect depending on speed factor, due to this design. The reaction forces to accelerate the wheel revolution which is the linear depressing of the piston inside a wheel will be reduced linearly since it could move freely due to its push-arm. That is the more speed in revolution does not need the same primer impact of linear force reacting all the time to keep the wheel revolution in a constant high speed or accelerated. This means a particular consecutive reduction in potential power of the piston (i.e. the fuel combustion needs) during highly speed, that will

be required to produce these impact powers consecutively on wheel. This means the said fuel demand for highly speed situations of engine, could be reduced rapidly while reaching highly speeds and so on. This with other criteria concerning the distance of push-arm depressing formula against the combustion force. A relation to the wheel revolution speed and the decreasing of linear movement of the pistons while increasing this speed, which may reach to the minimum reciprocated linear force effect situation(minimum piston displacement) on the wheel in the highest speed . A physical concept implemented here on wheel's rotary dynamic speed and its acceleration and the linear (piston) force effect consecutively, to reduce these reactions due to speed effect in highly speed.

 The other effect is by using the physical principle of how a space-ship is escaping from earth-gravity i.e. a technique which allows a space-ship fly free from Earth Gravity intensity zone by employing the centrifugal concept. This system employed this concept also inside the engine in a very small sample but in reverse reaction, by countering this force. The piston cup(piston top and gases mass in the chamber) is to be assumed as a mass with freely movement under the effect of speedy circular circumference zone (as a space-ship and the wheel as earth while increasing its speed). The more speed, the more force to let these masses try to escape from its central gravity in consequence reactions, the under-pressure gases happened instantaneously after fuel combustion in chambers will counter these reactions since the pressured gases in a closed space (the chamber) will reflect this outwardly centrifugal effect reacted from the piston back again to the wheel via the piston face itself by the gas physical characteristic being under pressure in the chamber(s) in a closed space to act like a balloon for reflecting any reaction, back on wheel which is the only free to rotate more as pivoted on crank of engine, adding this additional power to act positively on wheel again. All these influences connected with the physical centrifugal concept employed here. Even the distribution of pistons in wheels and achieving the balanced situation at highly speed would be considered.

These reactions appeared due to employing physical concepts related with the circular shapes of members used in the discipline of this system, the resultant would be called additional spherical sustained reaction on the engine (Fig 18/25).

The mathematics analysis for all mentioned concepts could be achieved easily.

A computer formatting calculations and conclusions for a piston weight, a wheel diameter, type of piston push-arm resistance, fuel output, the design and kind of application, the reduced spaces at increasing speeds, for achieving the required dimensions for each option. The graphical indicator diagram analysing deduction of chamber expansion at various speeds and its exact fuel need for the smallest expanded chamber reduced space, to be used in an advanced controlling system e.g. a computer to observe these potential effects with relation to each options to connected with feeding device to reduce actual fuel consumption at highly speed. These potential effects still neglected and lost in the conventional systems.

This is the practical advanced way of reducing the fuel consumption in highly speeds by using this power system which is designed to use this criteria !.

IN GLOSSARY (Philosophy of utilising Physical Centrifugal technique) (Fig 18/25):

This system is utilising a theory, which used in charging water or air e.g. any liquid by a concept of a "Centrifugal Pump or centrifugal compressor" rotates by automotive power resource supplied from outside.

Using the same theory for this design but in a counter way of reaction. Since the liquid used here inside is replaced by a specific one containing potential energy, an easily analysed chemical energy liquid, that is the air-fuel mixture. Which is being used first in this discipline, to produce chemical energy force inside this system to use it for supplying system automotive power requirement. By making this energy acts in a way to make it rotates by an inside automotive power source. Then using the physical reactions appeared in this discipline which is similar to centrifugal pump, due to speed reactions on a mass located on a circular zone, to act on pistons-cup (mass of piston and combustion emission of expanded gases in chambers), which seated to be <u>under this influence freely</u> to be effected to be driven outwardly consecutively in the meaning of reducing the linear displacement of piston due to fuel combustion without losing its impact on the wheel, as relatively to their particular place on circular-zone in this system. This influence will react in a reverse direction in this discipline due to emission of pressured gas pad in chambers to act as elastic resistance as a balloon of gas in the chambers upon pistons to counter this influence to act back again on pistons which are already pushing their wheel(s) to rotate to be as physical additional resultant acting positively on pistons, i.e. engine consecutively at highly speed.

In the meaning of using this new principle of centrifugal concept employed in automotive power discipline for the benefit of increasing engine output by using the reflection of inside centrifugal reaction, to use these as a criteria to increase output power of a said fuel or to increase acceleration rapidly or to reduce the said consumption in this integral engine system. These invisible(or indirect) physical influenced reactions in additional to the exhaust physical aerodynamic effecting on combustion intensities are due to advantages of circular shape physical utilisation in this engine so it called (*The spherical sustained reaction*).

The performance of the engine depends on many constant concepts and the observation of its missions here are without mathematical equations. Since they should depend on assumptions of industrial laboratories calculations, dimensions types of alloys, types of output applications, fuel and accessories data, all these could be assumed and could be formatted by computer programs for each option.

NOTES/ *1./* Since this is a complete new system, the inventor tried to use the simple English words, with some names of components used in conventional engines, however these names (as specified) are not necessarily the actual standard names of these parts, they may change according to the developments.

2./ All the prescriptions and declarations as for the enclosure 25 drawings which are the references that declare all the compositions typically done by Auto-cad program drawing. (Drawings details are the reliable references before words).

SPECIFIC PROPOSALS :

1. Light solid alloys for power wheel unit might be reinforced by a hard solid alloy in high torque stress places (i.e. crank-wheel hole, middle panel of wheel between the cylinders, cylinder bases and modified wheel anti-scratch circumference).

2. Light solid alloys for the piston's disk as the specific industrial requirements.

3. The push-arm resistance capacity for piston must depend on type of : engine output, acceleration, speed, application, type of design, fuel...etc. The flexible elastic system may be consisting simple metal spring (i.e. that used in weapon industries as for automatic fast canon refill spring). The hydraulic closed system could be used (i.e. of gas or oil) with the heat resistant seals may be used for the piston elastic push-arm. The metal spring could be in deferential circular diameter dimensions or even in its metal cross sections, for bearing different power ranges.

4. For radian gas seal mass: could use a self-lubricated Graphite(carbon) alloy or hard specific metal alloy with special lubrication system in the engine case using the advantage of one direction wheel rotation with special trenches and holes. Or specific plastic solid compound material with anti-heat characteristic, the type, shapes and sizes might be varied from different industrial resources, for minimum sufficient contact. Three types of seal mass, one for anti normal air, one for anti air-fuel mixture, one for anti-hot gases after combustion occurred before exhaust penetration. The same principal for all .Or use couple of seals for two-way effect i.e. opposite lock reaction in one seal mass unit. Wangle seal could be used in each seal mass unit i.e. not in rotary part here but in the case that provides more efficiency and workability since they will be used in a fixed place acting on a fixed axis maintaining a constant axial positions for contacting wheel circumference surfaces which fixed on one constant axis in this system (not parabolic rotation !).

5. The big circular seals between Case and wheel for sliding and anti-penetration, are of couple three or more stainless steel ring bladder inter-lock gathered as a slide bearing ring device or as industrial required. Or by special wheel's edges with sharp design to inter lock with engine Case ,a specific technique as required to reserve the mod on wheel depending on design proposals . (Fig 2/25 & 3/25).

6. Oil, gas, ring seals in pistons are by using the specified required alloys.

7. The oil pads are of light aluminium circular plate alloy with special radius grooves for oil cooling with smooth hard specified alloy edge for controlling timing of valves-bars with chambers positions, the timing control for the two valves in one pad or each in a pad, the timing depends on the design data and other requirements.

8. Oil is used for lubrication & cooling the power wheel units, this oil could be cooled by water or air cooling sub-system in the engine case or out side the engine.

9. The distributions of oil and cooling water grooves in the Case are as for industrial design of the Case to cool the engine returning oil in the Case and the engine.

USEFUL INDUSTRIAL COMMERCIAL CHARACTERISTICS :

1.   A simple easy to manufacture and less components parts for the final products.

2.   High output related to the size and cost, a system contains pistons with rotary operating using the exhaust aerodynamic and other potential power advantages.

3.   Using a new principle in charging the air-fuel mixture to the chambers, i.e. pre-compressed air-fuel mixture, from out side with any pressure needed for the

required performance, not as the old principles which sucking the air-fuel mixture to the chamber and compressing it to be in pressured situation by the same piston with its way of losing power stroke and energy and relative slow acceleration . This means using of a jet technique in charging fuel, in this design which will give high performance as fast and better fuel burning as fast acceleration engine needs without limits related to other specifications.

4. The pistons in this engine connected with a relevant free flexible push-arm working as elastic resistance, using various resistant types depending on the engine design and power data occurs in the chamber at firing stroke, (types depending on fuel and design). This characteristic will apply good specifications, one of them is in reducing the sudden impact and will uniform stress of high power if occur on any piston(s). In away that these push-arms will transfer stresses of pistons uniformly on the Crank i.e. making the engine more smooth, reducing the vibration. The elastic flexible piston depressing will allow a good flame propagation (as combustion chamber space is automatically controlled), and the same reason to prevent detonation in chambers.

The other advantage is to store some of it (the stress) to get use of it later (it will charge the piston elastic resistant). To use it in the same purpose i.e. transfers it later to positive reaction. The design will use the stand-still locked gases occurred due to fuel combustion upon the piston (in chamber); in away using the stored energy again to use it in the same direction (this happen fast, increases in high speed). The very next situation where the pressured gases (as stored energy) start to penetrate and release out (in exhaust stork), from the exhaust modified opening. The charged resistant push-arm adds extra power on penetrating gases as it starts returning to its regular form, more potential aerodynamic power exists by reversing this power with the elastic assistance via specified exhaust opening, (countering the theory of atmospheric flying principle as aerodynamic reaction).

The aerodynamic power of the penetration of the chamber's pressured gases from graded specific opening of exhaust; will act with more power on the wheel.

The analysis and conclusions could be confirmed by a sophisticated industrial laboratory using physics concepts and relative mathematics equations.

These potential powers would act as a positive summation resultant reacting on piston causing more power added to fuel combustion pressure in chamber that reacts on piston as additional power effects on wheel to increase engine output.

The centrifugal natural power, reacts on free pistons (cup) since they are placed in the circular zone of rotating wheel ; to produce other reactions in high speed.

These potential invisible reactions would be used with other analyses to minimise the fuel consumption by reaching an assumption situation between highly revolution speeds and depressing of piston(s)due fuel combustion instance, using data of push-arm resistance and relations of speed with dimensions and fuel, a computer formatting device analysing these criteria for each option, (Fig 18/25).

The heat energy advantage (if used) would tight the flexible push-arm of pistons with heat increase especially in using a gas, hydraulic resistance, which could reduce the elastic movement of pistons (increase the resistance). It means reducing the sufficient capacity of charging air-fuel mix for the same output later with the continues of working time. This special design will agitate (at fuel combustion) these physical nature's powers to appear in a situation could magnify fuel output to be in the best potential power related with speed in this engine.

5.   The oil services mainly depends on a natural constant principal with a special design that the oil flow will increase with the speed increase naturally not mechanically (as for conventional engines). This will be done by a centrifugal concept depending on the pads designed groove by feeding from central tunnel in Crank via relevant holes with relation to its distance from oil tank in engine. Magnified with speed increase, cooling the wheels and disposing pistons oil. This characteristic will lead to use the far pad in crank as huge oil pump by using high hydraulic specific grooves(trenches), for sucking oil from Crank to supply oil in Case for those seal masses needs and to cool Case in a best way. The usual oil pump could be cancelled if the oil tunnels in the case terminate at feeding (middle) oil tank of the central canal. The central canal in crank would not effect on the actual moment of inertia of the crank as its cross section is always circular.

6.   The pistons with their free flexible arms will reduce the reciprocated movement to minimise it decreasingly (the distance between upper and lower piston's dead points); due to increasing of engine speed, in this design. This matter reduces displacements of main engine parts (pistons) movement while increasing speed, (not kept in constant displacement at high speed as in conventional system!) by implementing physical concept related to a spherical rotating in speed and accelerating by reaction of linear forces effects on it. The reduction of push-arm depressing distance with increasing wheel speed due increasing engine's speed

would lead to theoretical assumption of a minimum movement in the very fast speed. It is a physical criteria of the consecutive reducing in chamber's expanding space for fuel at explosion and the way of this characteristic transferred by the same emission gases in chambers to reverse it to act positively on engine output. It is one of mighty God miracle in creating the very huge Space Universe and the little knowledge of man on that , one of what's concerning the spherical shape bodies, that is the centrifugal concept , man is trying to use this concept in reducing (said)fuel consumption in his very little engine, while increasing speed, as most pioneer characteristic to be utilised by using advanced accessories.

7. This engine system does not contain those valves that used in the old engines with their timing articulated connecting system, (camshaft, gear, pinion.. etc.) (Those valves with their mechanism however will limit the high speed of the engine since they may fail in high speed, as they need complicated frictional slippers and accessories for timings systems, even using more valves number for each piston in recent engines). Those things are not existing in this system i.e. cancelling their weight, noises and expected air smoke related with any of their defect also cancelling their problems of failure that may happen in high speed.

8. The air-fuel mixture quality can be controlled easily in this engine from out side accessories, in two ways by controlling the supplying pressure and also by controlling the fuel mixture, or both together depending on design data, however the system may not require a same(ideal) uniform fuel compression ratio in all its chambers or in all of its working stages, since independent pistons performance characteristic with their ability of various displacements providing flexibility in the engine to make this system easily uses different types of fuel efficiency, any gasoline(Benzene)octane, or Jet gasoline or even Gas fuel could be used after reconsidering the mixture accessories requirements for charging these fuel.

9. Cooling and expelling exhaust gases of chambers from outside by puffing air (scavenging) directly on it at end of exhaust stroke. This will control the heat of piston cup and supplying perfect adiabatic efficiency of air cooling technology for pistons in addition to the wheel side-walls oil cooling & enthalpy of cylinder walls. The air also will prevent the remaining of after burning carbon (soot) and will complete to oxidise unburned carbon oxide gases i.e. (CO) directly to (CO_2)or (H_2O), same to complete oxidisation for the sensitive nitrite oxides (NO_x), (and SO -if exist). This a practical way for anti-pollution treatment technology inside

engine, in a way to help conserving the environment and to prevent occurrence of harmful acid rain in industrial territories, all these missions could be under a perfect control. When there is no sufficient time to complete expelling exhaust gases of a chamber* in a highly speed, it is possible to make this mission repeated for each twice revolution of this chamber, by having a management(as this system permits for that) to make the fuel feeding for it* to be for each double revolutions consequently & harmonically .

10.   There is a suitable way of lubrication for the pistons that only the moving one will be lubricated when it needs to. Each piston has it's own private oil pump, and the lubrication system designed in away to reduce too much the pollution of air-oil smoke, since no crank case-oil sump bellow the pistons, however a leakage gas affliction will not cause oil smoke as much as old system does; if this happen.
There would be an air pad(s) under the piston(s) that could use its advantage in a special piston design to maintain a sufficient pressure in high temperature beneath piston to use it to be utilised ….for longer seals maintenance period and for output. This way could be connected for dual piston effect in one wheel.

11. The distribution of piston (cylinder) angles in the central crank in the engine will not need a balance weight which existing in regular engine. The metal bearing slipping pads on crank shaft for stress points lubricated to reduce friction on crank shaft which affected obviously in that system at high speed. These are not required in this engine system. The way of emission gases exhaust rapidly with the circular rotation's direction will minimise the stress on stroke final seal masses and helping a good lubrication mission for all seals.

12. This is a specific design in distributing pistons with its unique way of piston free movements while rotating the Crank (torque crank shaft). The principle used here will not need to distribute the stress for every combustion (piston) unit, as for old regular engines in all working time. That happened in the old system which all connected with a zig-zag crank shaft; each one with its special angle in slipping point guarded with metal bearing pads. Meaning all the combustion pistons will move consecutively (mutual) side by side equal, in the cylinders due to the rotation of the crank shaft, all the time, this increase with speed acceleration causing more friction, heat and vibrations, more lubrication need, which all affect on the engine efficiency . This new system is not working in that principal, it reduces piston(s) movement in a counter way with the increasing of speed, due to

physical concept implemented on this discipline, to reduce bad effects on engine, even it can reduce the fuel consumption in highly speed using advanced controller systems depending on the criteria of rotary wheels and their pistons harmonic linear movement and its performance on certain speeds &applications.

13. The best seen characteristic for this engine is the multi-output powers which can be changed in various ranges not even depending on the revolution speeds of the engine but on the required movement of the working pistons inside the engine (automatic power parts output). Like for example all piston in used supplying 100% output of the engine for heavy work in a car engine(4x4 wheel in work), or 2/3 or less of parts in used for high speed or 1/3 or less of parts in used for just to keep the engine in Idle working situation. This could be done in away that even its oil services could be stopped by controlling their relevant centrifugal air outlet .

This characteristic is very useful: in reducing actual fuel consumption, reducing pollution & providing longer maintenance. This new engine can be produced as engine for every work (multilateral-purposes) in one equipment(i.e. one vehicle) which is automatically providing various ranges of output as required, without effecting on unused parts or causes tough vibration, (i.e. an auto output engine) as for different ranges of maximum Hours Power e.g. excellent use for 4x4 track.

SHIRWO + Automatic Need auto engine will be called (SHIRWAN) SYSTEM {S.H..I.R.W. Automatic Need = SHIRWAN for automatic-power-output engine }.

The heavy transmission gear complex in this engine could be minimised or even terminated but of course keeping the reverse position in work .

14. Since there is the ability of stopping piston's movement in this design while crank continues in its rotation plus the circular slice machinery. The engine could be combined with an electric power engine mounted on the same crank or by clutch as advanced engine design with very practical use, it is a fuel combustion engine with electric power engine in one unit set . Depending on the simplicity of this design which can charge an electric battery when the combustion engine working. The electric power engine could be used directly instead – if it will be required when a situation needs i.e. a crowded city, to reduce the pollution. This is a piston - electric output (combustion - electric) in one combined engine unit.

15. In addition to other characteristics, proposals and options which can be obtained in industrial laboratories this machine will fill the gap between the normal

piston combustion engine, and the turbine Jet engine using their-all-good characteristics together in one engine unite, it will use the good characteristics of combustion piston (and rotary) engine in economic fuel consumption, slow rotation speed if required, small engine and easy to manufacture and maintenance, with the Jet characteristics of high power, high accelerated speed if required also by using the aerodynamic power of exhaust gases with other physical potential powers; all in this integral design and cheap engine.

16. This design will open the wide gate for the computer participation in controlling all engine activities and its characteristics performance by using advanced controlling accessories with economic industrial influence in the age of computer.

17. This engine could work in a vertical direction engine related to the torque crank since most of engine oil services depend on centrifugal concept related on speed. Its important characteristics and the ways of reducing(decreasing) fuel consumption rapidly with high speed increase, this will lead to use it mainly in high speed equipment that needs less reciprocating piston movements which makes it very qualified engines for Hoover Craft or flying equipment.

More advanced research on it will continue, for example computer formatting ready programs and the use of advanced Laser ignition could be used .

18. The variety of design options on this system could be implied easily since the main (elastic) parts of this system could be used from the variety of elastic devices springs or hydraulics used in the automatic re-fill emission weapons, those various machine-guns, the fast-canons, i.e. those weapons industries could participate practically indeed by a good part of their products in supplying main parts of these engines, to start changing those industries for man's civil and peace purposes ! .

DESIGN PROPOSALS AND OTHER OPTIONS :

1. This engine could contain many power wheel units depending on the out put torque power, with a relation to the diameter and number of cylinders in each wheel, the various proposals and options of this system provide extensive use .

2. The power wheel units could be in different diameters for kinds of engines, the principle of piston's moment effect on the Crank will be considered in related to output power using the required wheel and cylinder diameter in any engine design as these are some engine options. (Fig 2/25)

3.   Double ignition systems (accessories) in one large (super) power wheel unite, one or more in an engine, could be used as some engine options. (Fig 24/25)

4.   The main canal(tunnel) for oil supply in the crank could be seated out side the crank. A longitudinal tunnel connected parts on the crank as a canal across all parts (that stickmen together), parallel to the crank line as its boundary, with holes for each part, for oil feeding, considering the main intake and parts balance. The oil supplied for radian seals by specific tunnels in the case via modified pad.

5.   The water could be used for cooling power wheel units by a specific design for Case with more extensions between the wheel units containing canals for water, or using air cooling system ,as these are some options .

6.   The difference of cylinder number in a wheel depends on the diameter and speedy output power of the engine as these are some options, (Fig 14/25, 24/25).

7.   The cylinders in each power wheel unit in the same engine could be in various diameters as a specific in each wheel with relevant accessories as required for Automatic power engine, as options of Auto-Engine, (Fig 15/25).

8.   The fuel spray system can be in one set for all air-fuel mix by a pre-mixed fuel feeding the valves, or could be separated pipes control for each power wheel units in the engine, controlled by advanced computer system, as required for Auto-power engine .They could be substituted by a direct fuel mixture injection on each chamber by additional Case fixed device for each wheel. (Fig 21/25, 22/25).

9.   The fuel spray system could be controlled by a computer system to monitor the required spray mixture with air and could vary this mix for each type of gasoline octane by automatic device as required for multi -purpose Auto-Engine .

10.   The use of different wheel data in one engine; with specific relevant accessories as required with automatic control for varieties in output range . This is the automatic multilateral power engine, Auto-Engine (i.e. Shirwan engine).

11.   The places of the radian Case seals can be changed depending on the design data and type of application depending on the industrial production.

12.   The exhaust opening could be in different grade openings and angles related to engine design and fuel criteria and could be in mechanically changeable design for wings grades and directions by a mechanical device control.
The exhaust opening could be in opposite direction depending on Case design.

13.   The flexible (elastic) system of piston push-arms could be in various types for different engine design (or even with differential diameter along one spring) using

metal spring, gas or oil hydraulic device - heat resistance - like those used in automatic gun weapons, it might be more tight and qualified by heat increase !.

14. An advanced new modified system under the name of (connected hydraulic wheel unite system) could be used, that can get use of the impact power on a piston at firing stroke instantaneously to transfer a part of this power to effect on opposite direction on the other piston in the same wheel at a position when its combustion gases (of previous piston) start to lose from exhaust opening. In a way to supply impact force from inside the cylinder to push piston outwardly faster for expelling those gases from the chamber. Accelerating them to release faster from the graded opening. Which will produce more reaction on the opposite direction increasing turbine power on the wheel. This is a technique of the connecting hydraulic system of two pistons. It could be working also between the spaces beneath pistons in one wheel .This is advanced modified option as a part of the development researches on this system. (Fig 12/25).

15. The central oil canal in the crank would not effect on the moment of inertia of crank circular cross section, as this depends on the size, diameter and metal capability of torque resistance of Crank related to its canal diameter. The usual oil pump could be cancelled in a design could make oil tunnels in Case driving oil to the middle oil feeder tank that feeding central oil tunnel in the engine crank.

16. The mechanical ignition distribution could be in advanced electric design. It might need additional timing device as for old system but with more simple method, and even could use clever computerised device or (Laser) due to the fast rotation of the engine as a part of advanced developments on this system.

17. The metal industry for alloys, the grooves and tunnels could be easily done with the facilities of metal casting, and drillings available in recent manufacturers.

18. This engine could be designed in a vertical crank(shaft) direction with the same system principal. It is because of most oil services are depending on the centrifugal energy which could work in any direction, the engine oil pump could be cancelled. This means it could be easily used for flying equipment or Hoover craft regarding the simplicity, the speedy efficiency, the output power and the small size. this promising generation of clever engines would be used for advanced small Hoover craft (or a composite vehicle as Automobile and Hoover Craft or running and flying transportation equipment) by implying this cheap system with using of advanced computer control, (Fig. 23/25).

THE DRAWINGS CONTENTS

Important note: The drawings were in colour typical assumed dimensions using A2 paper size done by Auto-cad diskette program to declare the compositions of engine. They are now(here) in scale for A4 and in black & white in the enclosure set of drawings as required, also they are not in scale for actual industrial use.

FIG No (Drawing. No),

1/25 (1) : GENERAL SHAPE

2/25 (2)   : TYPICAL POWER WHEEL UNIT IN HORZONTAL SECTION.

3/25 (3)   : TYPICAL POWER WHEEL UNIT IN VERTICAL SECTION.

4/25 (4)   : TYPICAL SPRING MODIFIED CROSS SECTION.

5/25 (5)   : TYPICAL THREE-POWER WHEEL UNITS SECTION PLAN

6/25 (6)   : TYPICAL POWER WHEEL UNIT OIL CANALS , ANALYSIS

7/25 (7)   : TYPICAL COOLING, LUBRICAITON PAD

8/25 (8)   : TYPICAL PISTON ANALYSIS

9/25 (9)   : TYPICAL ENGINE PARTS

10/25 (10): TYPICAL DIMENSION OF POWER WHEEL UNIT

11/25 (11): PISTON PUSH-ARM _MODIFICATION

12/25 (12): DUAL CONNECTED PUSH-ARM OF PISTONS

13/25 (13): VARIOUS PROPOSALS

14/25 (14): VARIOUS CYLINDERS IN A WHEEL

15/25.(15): VARIOUS PISTONS DIAMETERS IN ENGINE

16/25 (16): VARIOUS WHEELS DIAMETRES IN ENGINE

17/25 (17): FOUR-POWER WHEEL UNITS IN ENGINE

18/25 (18): FORCES ANALYSIS IN THE ENGINE

19/25 (19): TYPICAL ENGINE PERFORMENCE

20/25 (20): A PROPOSAL FOR SEAL-MASS DESIGN

21/25 (21): TYPICAL ENGINE ACCESSORIES, PROPOSAL 1

22/25 (22): TYPICAL ENGINE ACCESSORIES, PROPOSAL 2

23/25 (23):A TYPICAL ENGINE FOR FLYING EQT- VERTICAL CRANK SHAFT

24/25 (24): A TYPICAL ENGINE FOR A WIDE WHEEL

25/25 (25): ALL DETAILS OF THE ENGINE UNIT

DRAWINGS DETAILS - DECLARATIONS...(IN ALL THE DRAWINGS)

1. Chamber (combustion room).

2. Case   (engine Chassis).

3. Wheel   (Power wheel unite).

4. Wheel modified circumference (scratch resistant alloy).

5. Metal spring   (straight or inclined).

6. Crank   (torque-crankshaft).

7. Piston push-arm   (flexible shaft device).

8. Piston push-arm base.   (cylinder base).

9. Spark plug.

10. Piston oil pump (built in with push-arm).

11. Oil tunnel (canal) for piston oil feeder.

12. Bolts for fixing seal base (in Case).

13. Pinion, gear ring to transfer rotation to other device (for ignition).

14. Solid steel ring for piston lock (in cylinder).

15. Canal for oil service.

16. Regulator adjustment for big seal mass.

17. Pad for oil cooling & lubrication.

18. Ring seals in the piston.

19. Big seal mass in Case (anti-gas).

20. Air-fuel mixture charging device (pre-compressed mix. feeding).

21. Air charging for exhaust stroke (on chamber).

22. Valve for air pipe(mechanical- control). / (22d - oil check valve).

23. Canal for water cooling service in Case.

24. Central canal for oil supply - in Crank

25. Engine base flexible holder.

26. Big circular sliding seal in Case-wheel (anti-gas, anti-oil).

27. Ball bearing device.

28. Oil usual pump (for engine).

29. Water pump.

30. Exhaust aerodynamic specific opening.

31. Cladding perforated hollow pipe(for piston oil pump).

32. Case main assembling bolts

33. Ignition distributor.

34. Middle oil tank (feeding tank for central oil canal).

35. Oil main tank (the engine oil sump).

36. Oil pump intake.

37. Oil supply pipe.

38. Oil refill opening / (for atmospheric pressure equaliser-ventilation).

39. Oil lock washer.

40. Tightening ring (washer with pin).

41. Cylinder for piston in the wheel.

42. Piston in the wheel.

The following is Abstract then 30 claims which are seated in simple language to obtain the new technical features and its industrial and commercial advantages provided by each claim on this engine and/or option using SHIRWO System .

ABSTRACT

SHIRWO S. :-(_Spherical-Sustained-Sliding_ / Harmonic-Hydraulic / Independent I. C. Intensities / Rotary - Reflected reactions / Wheels / Operating) System, is an internal Petrol combustion spark engine composing types of the recent known combustion principles (those separately used in automotive power) i.e. the piston, rotary and turbine, to perform all together in a compound system unit designed in integral sliding mechanism to achieve the best way in transferring fuel potential combustion energy to automotive power, with minimum power lost inside this engine which has flexibility to bear different ranges of combustion power intensities to be controlled to perform uniformly or independently but in harmonic effect inside the engine, using pre-compressed air-fuel mixture to be boosted to the engine, moreover this design is employing physical dynamics effects due to elements movement inside which appear at engine's work, to be utilised positively instead of losing them as a lost energy inside the engine, by employing techniques of using Nature Physical dynamic concepts to be implemented on these elements to utilise their effects for the benefit of engine output, to make this system depending on fuel potential chemical energy for internal combustion in additional to inside positive consequence physical effects to produce its final improved output, a system consisting many theories act in association to provide best fuel utility in producing automotive output power related to power-weight ratio, a meaning of reducing said fuel consumption, this engine (Fig 25/25) comprising from a cylindrical Case **2** having one or many wheels **3**, mounted and geared on a straight central (crank)shaft **6** inside the cylindrical cavity of Case **2** for rotation coaxial therein, the said wheel(s) containing at least one cylinder(of piston) **41** in centre-side perpendicular to crank axis, in which it is opened from outwardly upon wheel rotating direction facing cavity of Case **2**, a piston **42** mounted inside the cylinder which has the ability of linear movement therein. the piston **42** top together with the cylinder **41** wall (bore) and inner circumference surface of the Case **2** defining a combustion chamber **1**, the piston **42** is mounted to the other closed end of the cylinder **41** via a **free** flexible elastic push-arm **7**, circular seals mounted with the Case **2** around the wheel **3** along its circumference **4** on each side edge **26**, to isolate wheel performance as well as three or more of seal mass **19** in radial location on the wheel circumference **4**

width at designed distances to guard the mod of stroke situation zone in the wheel **3** during the work of the engine, the wheel(s) **3** conducted separately, by fuel mixture inlet(s) **20** via valve(s) **22**, spark plug(s) **9,** exhaust pipe(s) **30** and air supply inlet(s)**21** via valve(s)**22** mounted all in Case **2** around the wheel **3** the pre-compressed air-fuel mixture boosted (fed) into the chamber(s)**1** from outside by a valve **21** away from firing stroke zone, air is puffed at end of each exhaust stroke, all by using same main accessories (cylinder to store pressured air with recharging compressor, pipes, and spark distributor adapted with the Crank),fuel sprayed for air-fuel mixture by a device **20** before feeding as pressured mixture to be controlled from out side, exhausted gases are expelled via a specific opening **30** mounted in the case, valves **21,22** opened mechanically in the right time against chamber(s)**1**, controlled by edge of circular metal pad(s) **17,** two metal pads **17** used for oil and cooling services around and coincide with (each) wheel **3** working by centrifugal concept contain radius grooves fed with oil from central oil canal **24** by sucking oil from the main central canal **24** inside crank-shaft length via holes then discharge it to outsider case to supply seals with oil, piston-wall oil servicing is by using a rod pump **10** mounted in its push-arm **7** connecting piston oil network with crank **6** oil intake **11**, working relative to piston's movement, sucking oil from the central oil canal **24** feeding piston **42** wall contacting the cylinder **41**, then to be driven to the a pad **17** at the wheel side-wall, the pads **17** collecting the returning oil from piston(s) **42** in wheels **3** to the outsider case **2**, oil is cooled in the Case **2** while flows back to the main oil tank **35** on an end of Case which has specific air opening for pressure equaliser and ventilation for centrifugal requirements, the central oil canal **24** in crank **6** supplied with oil from middle oil tank **34** which kept filled with oil by usual oil pump **36** from main oil tank **35**, where more than one wheel are inside the case each wheel could work separately with its independent fuel and air feeding devises controlled from out side, when the engine rotates, chamber(s) will be charged with compressed air-fuel mixture, then reaches firing zone, then it sparks by a plug, then its mixture explosion occurs then pressured gases at power zone, start pushing the piston, making the piston static elastic push-arm dynamically charged to a depressed situation, while pushing the wheel to rotate, the pressured gases exist in the chamber will stay in standard high pressure while kept in closed space of

chamber that surrounded by seals from all sides (with radian seals contacting wheel circumference keep on sliding on it) at power zone, while rotating the wheel, using gas characteristic in closed space like a balloon to reflect piston elastic upward reaction (to return to its first static position) by chamber(s) gases hydraulic reaction to countering this force to the piston again then to the cylinder base e.g. wheel keeping the same power of a constant moment on crank along power zone keeping on pushing the wheel to rotate, when the chamber crossing last exhaust gas seal, these pressured combustion gases in the chamber will start to penetrate as exhaust gases, but from designed exhaust opening with directed wings in specific angles to provide effective aerodynamic energy power effected back again on wheel via chamber(s) which is under this effect according to escaping balloon concept with more pressure forced from piston by the release of its charged elastic push-arm beneath it, making this aerodynamic force working faster and more effective in adding additional positive power on the wheel as a turbine principle on wheel(s) as a positive effect of exhaust stroke, to be added on power zone, these missions will be followed on others chambers, pure air is puffed to each chamber at end of each exhaust stroke to expel exhaust gases from chambers, to reduce heat of chambers and to treat pollutant of these gases while still hot, as a built-in technology for treating emission pollution, this system has the pioneer characteristic of (independent intensities) as independent pistons performance, this engine has the ability of practical reduction for fuel consumption by controlling work of combustion intensity (unit or group)separately for the required application, its design is seated to use the principle of reducing the distances of reciprocated movements of pistons while increasing the engine speed by utilising physical concepts depending on speed factor in relation with centrifugal concept inside the engine to counter fuel consumption at highly speed, the final output presenting the compound performance of this system which is suitable for the computer age by its activities formatting control, its wide options based on the fact that it could utilise those various products of automatic refill-devices of canons or machine guns weapons for use as elastic push-arms inside these engines to provide the participation for weapons industries in fabricating this generation of clever compact power engines, (SHIRWO SYSTEM) is its trademark name and (SHIRWAN SYSTEM) is for Automatic output system. (The claims are followed on the next pages).

THE CLAIMS ON THIS INVENTION : SHIRWO S (plant App. PCT/IB 99/ 00178 -USP)

30 claims (Ref. to the drawings Fig 1/25 to Fig 25/25 and the pescription)

1.   An engine comprising a cylindrical Case having one or many wheels mounted and geared on a straight central (crank)shaft inside the cylindrical Case for rotation coaxial therein, the said wheel(s) containing at least a cylinder (of piston) in centre-side perpendicular to crank axis, the cylinder is opened from one side outwardly upon wheel rotating direction facing Case cavity, a piston mounted inside the cylinder which has the ability of linear movement therein, the piston top together with the cylinder wall (bore) and inner circumference surface of the Case defining a combustion chamber, the piston being mounted to the other closed end of the cylinder via a flexible **free** elastic push-arm, circular seals mounted with the Case around the wheel along its circumference on each side edge, to isolate wheel performance as well as three or more of seal mass in radial designed distances location contacting wheel circumference width to guard the mod of stroke zones of the wheel during the work of the engine, the wheel conducted separately, by fuel mixture inlet(s) via valve(s), spark plug(s), exhaust pipe(s) and air supply inlet(s) via valve(s) mounted all in Case around the wheel the pre-compressed air-fuel mixture charged (fed) into the chamber(s) from outside by a valve away from firing stroke zone, air is charging at end of each exhaust stroke, all by using same main accessories (a compressor with pressured gas cylinder, pipes, and a crank adapted spark distributor),fuel supplied for air-fuel mixture by a spraying device before feeding as pressured mixture controlled from out side, exhausted gases are expelled via a specific opening mounted in the case, valves opened mechanically in the right time against chamber(s), controlled by edge of circular metal pad(s) , two metal pads used for oil and cooling services around and coincide with (each) wheel working by centrifugal concept depending on centrifugal principal contain radius grooves fed oil from central oil canal by sucking oil from the main central oil canal inside crank-shaft length via holes then discharge it to outsider case to supply seals with oil and cooling it while driven it to main oil tank at Case end, piston oil service by using a rod pump mounted in its push-arm connecting piston oil network with central oil canal via intake hole, working relative to piston's movement, then ending it to wheel side-wall then to engine Case, an opening on the ceiling of main oil tank for centrifugal is available.

2. The engine characterised as in claim 1, has a discipline composing piston, rotary and turbine principles, to perform all together in a compound system unit designed in smooth simple mechanism to provide best utility for fuel combustion potential energy to transferred to automotive power in the engine .

3. The engine characterised as in claims 1,2, the said engine is using the new technique of concentrating the reactions of physical dynamic forces occurred in/by elements inside the engine, to be used positively in engine output benefit.

4. The engine characterised as in claims 1,2,3, the said engine does not have energy-lost stroke, all piston displacements in any direction will act positively during the work for the benefit of engine output, pistons could have various power strokes in one engine cycle to provide powerful engine output.

5. The engine characterised as in claims 1,2,3,4, this engine is using the exhaust gases potential aerodynamic reactions to increase engine output, by using a technique utilising physical concept (escaping balloon) on modified exhaust openings to reflect a turbine reaction on engine rotation, to be a useful factor .

6. The engine characterised as in claims 1,2,3,4,5, this engine is using the principle of Jet in utilising pre-compressed air-fuel mixture to be boosted vertically on modified turbine(s) axis contains flexible elastic piston(s)of this spark modified engine which utilised compound automotive concept(claim 2) to provide the best characteristics of conventional piston system as economic and easily controlled, in additional to a best characteristic of Jet system in a speedy accelerated powerful output, all in this compact engine to establish a connecting bridge on that wide gap between piston engines and Jet engines.

7. The engine characterised as in claims 1, to 6, this spark engine is using the pre-compressed air-fuel mixture to be boosted(to be fed) for its chambers to provide a best status for fuel combustion in squeezing powers and to supply rapid acceleration in a discipline has ability to bear and transfer deferent ranges of fuel combustion efficiency directly and safely to automotive power.

8. The engine characterised as in claims 1, to 7, this engine is using the principle of Puffing air on each chamber i.e. piston cup directly at the end of stroke exhaust while still hot for expelling (scavenging) exhaust gases, for reducing heat of chambers in each cycle, providing adiabatic effect, exchanging exhaust gases and cleaning what could be left of soot, thus in controlling pressure and temperature of air feeding, this mission could be

completed perfectly for any chamber in highly speed by repeating it in each double cycle by controlling fuel feeding of this chamber to be for each double revolutions, as automatically, consecutively and harmonically with other chambers, since there is ability of independent performance of any pistons.

9.   The engine characterised as in claims 1, to 8, this engine is using a built-in technique to reduce the pollution of exhaust gases within the engine, by puffing pressured air directly on the hot gases in each chamber while still hot at each end of its exhaust stroke, which will complete the oxidisation of all exhaust gases i.e. those sensitive CO & NO_x (and SO_x if exist) to be oxidised into friendlier status before expelled to the environment , it is also a way to prevent acid rain, this mission could be controlled for adding extra anti-pollution factors.

10.   The engine characterised as in claims 1,to 9, this engine using flexible elastic push-arms for pistons with the free various elastic displacements as this discipline utilise them all positively and effectively on the engine output, by a way of maintaining a perfect fuel combustion in each chamber, by exactly the required extension for chambers space to act in association with other engine effects as this is the flexibility in this system to use any mix rate (different compression effect) upon any piston while engine in performance, it could use different fuel (in octane factor) without mechanical disturbance, keeping the actual required chamber's combustion space for any fuel, keeping the best firing situation for any fuel efficiency to be utilised, terminating knocking, rumbling problems, this system is providing the flexible harmonic distribution of different fuel combustion intensities in the chamber to be transferred all positively to engine output automotive power.

11.   The engine characterised as in claims 1,to 10, this engine is using easy way of feeding the air-fuel mixture to each chamber as in the same (uniform) ideal mixture for all by one fuel spraying mechanical device to feed all chambers , or by using a separate (independent) spraying devices for automatic control feeding for each piston unit (or group of pistons) separately in this system to have the precisely required performance for any application to reduce its fuel.

12.   The engine characterised as in claims 1, to 11, this engine is using a specific principle of distributing oil services from central supply canal(tunnel) inside its straight crank via metal pads by utilising the Centrifugal concept on engine rotation, for discharging oil outwardly to engine case, providing good adiabatic

efficiency with good oil distribution to engine parts related to its speed, the engine oil tank far from hot combustion gases of chambers preventing expected oil smoke due to penetrating of these gases leakage on oil sump.

13. The engine characterised as in claims 1,to 12, this engine is using independent device for oil service in each pistons by its private pump working relatively to the piston's displacement, supplying the required oil quantity for each piston, (for piston wall touching cylinder wall) independently as the piston demands.

14. The engine characterised as in claims 1,to 13, this engine is using simple mechanism to bear any power range by transferring it to a sliding free rotating reaction by a straight crank mounted on it wheel(s) consisting piston(s) of flexible elastic displacements, the additional effective reactions which acting positively on engine output by employing a criteria of this system in utilising the advantages of this circular shape of wheel(s) in the engine could be called additional spherical sustained reaction of this system on the said fuel output.

15. The engine characterised as in claims 1, to 14, this engine has ability of conducting parts of engine performance needed for any engine application, maintaining sufficient independent parts of engine in work as needed for the required engine output, by the ability in using independent feeding devices for each engine part, providing the exact consumption to reduce fuel for any work.

16. The engine characterised as in claims 1, to 15, this engine has the ability of providing auto-output performances, by the ability of controlling any piston performance, any piston could work or stops as required during engine rotation, despite they are all on the same crank, this would be happened without influencing on other parts in the engine, related to the engine design concerning the pistons and/or wheels numbers in engine, and a control of the accessories , this provides the pioneer characteristic of this system (i.e. The Automatic Output Power Engine, SHIRWAN SYSTEM).

17. The engine characterised as in claims 1, to 16, this engine is using a specific design of the free flexible elastic push-arm for pistons, with chambers placed in the wheel outwardly circumference, employing the circular shape with its miracle physical advantages in reducing the linear movement of working pistons due to increasing rotary speed of wheel(s) inside engine, the piston's depress decreases with the increase of revolution speed depending on a

natural concept of a dynamic circular body rotating and accelerates by consecutive linear force(s) effects on the same rotary direction which will not stay as the same premier force(s) effect while increasing wheel rotary speed or to keep a constant speed , this criteria will be used to reduce linear force of piston(s) acting on a wheel which would be used to reduce the fuel needs required for the consecutive explosions in chamber(s) having reduction in its expanding, due to reductions of piston(s) displacements, means this system as it is boosting(charging) air-fuel to engine, it will reduce its fuel consumption while increasing its speed by utilising the speed-factor in this physical concept.

18. The engine characterised as in claims 1, to 17, this engine is using the principle of utilising the Centrifugal concept directly in highly speeds, to reduce the fuel consumption also, as this connected with the circular placing of the chambers with free movement of all pistons related with the weight of pistons masses and an assumption existing mass for the gases in these chambers, while keeping the same reaction on the wheel(s), at highly various revolution speeds, physical centrifugal reaction will be reflected by gas pad as a balloon inside these mentioned chamber(s) to act again on the same positive direction of fuel combustion inside the engine, this means extra descending in the said fuel consumption with the speed increase in this engine, it means this is a second way of countering the fuel consumption while increasing the speed, the indicator diagram for both claims 17&18 would be used in approaching a theoretical situation of minimum piston linear reciprocated displacement to program a computer control system for actual required feeding to reduce the fuel consumption that needs in highly speed, related to the engine & loading.

19. The engine characterised as in claims 1 ,to 18, this engine is using valves for chambers, controlled separately without using the essential articulated timing connection, e.g. a cam-shaft, this integral system is cancelling the main old slipping stress bearing points those exist on conventional engine's crank and cancelling those articulated parts and their weight in this new engine.

20. The engine characterised as in claims 1, to 19, this engine has a discipline seated providing facility ways in regulating and adjusting all engine activities, i.e. control of fuel consumption, output power, pollution treatment quality, the pre-heating of the engine , oil-cooling system, the use of aerodynamic power in output and the termination of the defected piston, the contact status of radian

seal in Case with wheel(s) as could be controlled mechanically or by thermal adjustment in relation to engine speed or when to be in used for Auto-Engine.

21. The engine characterised as in claims 1, to 20, this engine could be modified easily for various kind of power output, if keeping the same general dimensions, by only changing the qualification of elastic push-arm for group of pistons or all, with little changes in the fuel mixture feeding device(s) if required that is because of the free circular sliding discipline of the engine to bear any range of potential power and more it is depending on piston elastic push-arms.

22. The engine characterised as in claims 1 ,to 21, this engine could be in wide options depending on this system principal, for various proposals as different in power wheel numbers or diameters, cylinders(piston) diameters or cylinder numbers in each wheel, or even in dimensions of all these in one engine for the wide application Auto Engine, a connected hydraulic system for two pistons in one wheel could be used also to exceed expelling of exhaust gases more rapidly, a differential cross-diameter of push-arms metal spring could be used.

23. The engine characterised as in claims 1, to 22 this engine could be used vertically as its crank in vertical direction as a vertical engine performance, that is because the oil services here are depending mainly on the Centrifugal concept, and the air-fuel is boosting to the engine the speedy output efficiency would make this integral compact engine system is the most suitable for the promising small Hoover Craft and other flying equipment . (Fig 23/25).

24. The engine characterised as in claims 1,to 23, this engine could be designed in a dual or more ignition spark plugs in big diameters wheels, depending on the same system principal considering all the requirements, the exhaust openings could be placed as required or even used with moving adjustments

25. The engine characterised as in claims 1,to 24 , this engine could be used easily as a group of different-power unites (engines) on the same crank, to work as one engine for heavily application(generations) each engine could have its own oil services and control, to work or stop without influencing on other because of the sliding rotary design with independent effects of parts.

26. The engine characterised as in claims 1,to 25 this engine could use gasoline (benzene) in different kind of octane or Jet kerosene or even Gas fuel in the same principal, the existing of flexible piston push-arm could provide this capability, by just changing the feeding accessories or pistons push-arm.

27. The engine characterised as in claims 1,to 26, this engine however controlled by its pressure of feeding its options of Auto-engines for multilateral-purposes in performance could be provided by different proposals of modifications as :

A / Air-fuel mixture feeding pipe with controlled inlet for feeding pistons of wheel (the piston in any wheel- unit) by inlet valve regulator or management.

B/ Air-fuel mixture feeding pipes with controlled inlet for each wheel unit .

C/ Different pistons diameters for any wheel with their particular accessories.

D/ Different pistons numbers in any wheel with a modified distributor .

E/ Different wheels diameters with their particular feeding accessories.

F/ Different piston push-arms (elastic resistance) for any wheel(s) that might be used in a specific applications as a wheel unit(s) for fast acceleration, high speed or in extra heavily work or idle work, or related to other kind of fuel used.

G/ Exhaust opening places, angles, for the wheels its wings direction it could be moveable as required and the location of the last exhaust seal .

28. The engine characterised as in claims 1,to 27, this engine is using maximum fuel potential energy in output to be a powerful engine because of :-

A / Its longer effect and constant moment of piston Power stroke on Crank.

B / Its pistons strokes acting all positively on engine output no stroke lost.

C / Its minimum combustion energy lose due to its sliding rotary mechanism.

D / Its utilisation of the potential elastic effect of elements inside the engine.

E / Its utilisation of perfect combustion for air-fuel mixture in chambers always.

F / Its way of using the pressured boosted air-fuel mixture into the chambers.

G / Its utilisation of the aerodynamic power for exhaust gases in output.

H / Its utilisation of the physical powers reactions occurred inside the engine.

29. The engine characterised as in claims 1, to, 28 , this engine is suitable for computer age since its parts perform independently to fit prepared programs.

30. The engine characterised as in claims 1, to 29 this integral engine would eliminate the gear transmission box in a vehicle if used as Auto Engine, it has simple fuel spraying devices, it has safe high speed efficiency as the more speed the less vibration(i.e. less distance of pistons displacements) with high adiabatic efficiency, this system has wide options since it could use those various elastic devices used in refill usual automatic weapons such as canons or machine guns to change those products to mankind civil purposes ! . +++

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USPTO : <u>Serial No,</u> <u>Cnfrm. No,</u> <u>Filing Date</u>
09/ 582, 634   5682   13-SEP-00

US PATENT AND TRADEMARK OFFICE
Commissioner for Patents
Box PCT, Washington , DC 20231   Geneva on 12 Apr., 2002
(2nd envoy of a letter on 18 - Sep., 2001)
Letter contents : 8 pages + enclosures

Mr. Thomas DENION
        SUPERVISORY PATENT EXAMINER -TECHNOLOGY CENTER
       - The Examiners Crew
Dear Sir(s)

Sub./ Reply on USP - 1st action mailed on 29-June 01
(A letter of 2 parts + Enc.)

<u>1st part</u> : Discussing the formalities (pages 1, 2) :-

In the score of discussing the first detailed action from USP office on this application, I
would like to begin in thanking you for the preliminary review in observing your
general requirements, notes and mainly your scientific interrogations.
This action is seemed to consider unreliable edition, by mentioning 32 claims drawn in
the primer edition which had been sent at earlier time just to inform you about the
structure shape of this application. While a letter was sent to your office in February
later asking about the time schedule to start on prosecuting this application in order to
inform you the intent to send the actual plant edition (an edition which has 30 claims)
to be the actual addressing plant edition to USP !.
As this issue had been informed by telephone (on March-April 01) to the examiner
'Mrs. T, Thai ba and had been certainly agreed on, before starting the prosecution
procedure as that was clear to consider the addressed plant (last) application to USP as
the actual one for prosecutions on this application and neglect that (primer) edition.
I need to request in neglecting the article of (marked up copy) since I don't keep the
primer editions any more, however there is no change in application spirituality.
You may consider that primer edition reached USP before May 01 to be as market up
all by(..) if this needs to fit any formality since most of its wordings had been modified.
Please use the plant (last) edition as the actual application to USP since that had been
certainly informed to you as mentioned above and hence all the following reply
eventually will be relied on this (last) plant application addressed to USP .

In fact I tried to figure the legends of those intricate requirements to facilitate the way
of treating the defects and answering your interrogations since some of them seemed to
be interfered with each other, so in order to be able to reply, I have divided your first
detailed action into the following phases:
1- Requirements concerning the structure of this application, e.g. the drawings, the
     language of abstract, objections on claims 1, claims 3-(32) for informalities to be
     amended in wording, then advising for necessity to get an attorney(P. 2,3,4 -Action).

2- Rejection of claims 1-3, for lack of proper explanation on implying aerodynamic principle, for lack of operational language to describe the engine and a believe to consider this engine as it might be inoperative device ! (page 4,5,6,7,8).

3- Rejection of claims 1-3 for a believe on this engine as might be anticipated by four other cited documents however they had been described as inoperative devices (page 8,9,10,11 in the action).

These points show the necessity to put them in another order according to their serial importance on the application legends to be treated usefully and constructively without causing any interference with each other or to be misguided .

Starting first by disillusion that believe of whether this spherically sustained engine scientifically and mechanically is operative or not ! Since you built a presumption for the inoperative mode, meanwhile there is a sort of misgiving on a conflict existing of well known concepts as not conventional and asking for affidavits on it or prototype!.

Then to declare points of differences on that believe of 'anticipation' with four cited documents, those you have even described them as inoperative, in which you consider the independent essential claim to be rejected. Although this claim is determining the overall parts of this engine and how subjecting the design to employ certain physical concepts to be conducted in a perfect way with improving advanced characteristics. However it would be normal to have such expectations due to systematic domination, the long term interests and influence by the conventional systems still used until now.

Since it is quite obvious in this multiple professionals application to face difficulties or a sort of misunderstanding on the complex scientific legends for utilising various concepts existing and effecting indeed on the performance stages of this engine.

This reality shows how one system utilising many concepts beyond the conventional. It is for this reason I have proposed to let different classified experts to be involved in analysing this application (as mentioned in the 1st page of the plant application) and even the way of writing this application is to determine a complete industrial project.

In any way scientific argument is already appeared on this application i.e. on design spirit of this engine which is surely a healthy sign indeed to discover scientific truth.

Eventually this is one main goals for establishing any patent office as it should be.

So according to the above merits, my reply on your first action should be started and intensified essentially in declaring the way of employing quite scientific fundamental concepts which being applied in the system, then other requirements come in dues. (while I'm requesting for other break i.e. a request to have other actions to from USP to get the scientific vision on the discussions stated , then coming other formalities).

The objection on the language of abstract as not written by an expert patent attorney this will be done in due. Obviously the efforts to accomplish the rest formality needs may become useless without a certain change in the examiners built up opinions. Although the drawings are already re-treated as required to assist these merits, while amendment on referring the independent claims is done and more will take places consecutively, considering also your advise to assign patent attorney, that's only when all scientific interrogations would be convenient enough for you , as next actions show.

Please consider the whole details mentioned in this letter (1st & 2nd parts) and find Enc. the. amended plant application (2nd Ed.) with its amended drawings and documents. With my appreciation I remain.

Yours Faithfully
Shirwan AL PASHA AL BAHDAINI

Enc. :- *2nd part of this letter*
A complete plant application 2nd Ed.& 25 Drwgs. + market up documents + References

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09/ 582, 634   5682   13-SEP-00

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<div align="right">

Geneva on 12 Apr., 2002
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Mr. Thomas DENION
SUPERVISORY PATENT EXAMINER -TECHNOLOGY CENTER
- The Examiners Crew

Dear Sir(s)

<div align="center">

Sub./ Reply on USP - 1st action mailed on 29-June 01
(A letter of 2 parts)
</div>

<u>2nd part</u> : Discussing the scientific legends of application (pages 3 to 8) :-

The following paragraphs are the reply on USP office-first action dated on 28 Jun 01
1- The scientific interrogations (according to performances serial of this engine) :
(<u>1-1</u>)- The interrogation on the engine performance to be considered by your definition as inoperative device known as closed turbine pocket.
(Ref. to page 7 in the action).
The basic design technology of this engine shows a main legend which is to enable to employ the well known physical concepts, those which may inversely proportion with an available factor in any engine, that is the 'speed' to have them in particular combined physical criteria to be utilised for the benefit of the engine output. The design was plant in association to provide practical ways in highly speeds stages to reduce fuel consumption or to increase the power or acceleration by a said fuel. Also to be able to conduct the engine by independent controlling device to feed the engine (there is no relation with engine activity), although the engine could supply indirect power resource as to assist this device to work (i.e. by a conversion belt).
Also it provides ability of independent conducting for each combustion intensity inside the engine without influencing on the others, even on services (oil, cooling).
 It introduces a unique way in conducting this engine which utilises legends of the physical concepts connected with the circular motion of bodies and its benefit, by using the Kinetic energies to overcome the high rate lost of valuable fuel energy in all the present advanced automotive engines and finally in actual use of computer.
This engine depends on many elements constructing its performance, fundamental physical concepts of dynamics, elastic characteristic of material, the best way of utilising fuel combustion and the best workable mechanical sliding design, these elements are put to work in association to produce better fuel utility output.
 The design of this engine has considered many expectations to overcome, one of such a stated device 'closed pocket turbine' as described inoperative to be in your opinion similar to the engine described in this application that I absolutely couldn't agree with you on that opinion for these gathered reasons:

a- The cylinder(s) has flexible piston, mounted in each wheel on the centre-side of wheel axis with central line angle(>45°) on its wheel tangent i.e. larger than 45°, a certain force on piston will urge it to deform and transfer part of this force to the wheel then acting like sway pocket to rotate this wheel due to a moment resultant .

b- The air-fuel mixture charged in pressured mode or in supercharging mode.

c- The mixture charge will explode by timing spark plug, nothing will prevent this.

d- The piston is placed in a plant position against the spark plug at ignition timing.

e- There is one wall in the chamber has ability to move if urged by a force, that is the piston, to start to depress guiding explosion charge impact to be driven on it.

f- The flexible piston in the cylinder is affixed by elastic compression push-arm (ductile spring) on cylinder base, any force impact or increasing it on this piston will cause the piston to depress to inner ward due to the elastic deflection of its elastic compression device connected with. It is by Hook's law of elasticity that means the displacement characteristic is proportional to its force in a straight linear mode. Part of this acting force on piston will transfer to the cylinder base via push-arm causing this wheel to rotate as has sliding periphery edges. This magnitude is in plant design considering Modulus of Elasticity for push-arm.
> (Enc. Pages 154,155 in Adv. Level. Physics. *rd Ed. Ch. 6 Elasticity)

g- The wheel will rotate sliding the chamber's emission contents to exhaust zone.

h- The principle used here is the same used for explosion concept inside a canon to through a bomb and how to re-fill automatic weapons by its emission's gases .

The displacements of these pistons are in different magnitude depending on each explosion charge occurred in their chambers since each piston's elastic push-arm playing a major part in the performance of this system, that is to provide the actual spacing on chambers relatively to the actual required work to be done by the engine in order to reduce the fuel consumption to be according to the exact needs of work.
Modulus of elasticity for each push-arm will play this major part in this system by using different magnitudes in each option even in one push-arm e.g. starting its top (beneath the piston directly) in sensitive elasticity to deflect due to change of chamber pressure (the air-fuel mixture) at explosion to effect on its piston to guide the primer impact to be directed then to drive the whole explosion impact on the piston(s).
This is a similar to that old concept still used in fabricating cylindrical gun canons.
The magnitude of modulus of elasticity for a push-arm may be changed gradually directed to the inner ward i.e. to cylinder base as plant, to increase the resistance in a design connected with the whole engine features, by using different cross sections in ductile spring under pistons; to let more effective impact on cylinder base then to on the wheel(s) then producing moment (or as momentum) for rotation.
That is explained way the cylinders in this engine have more related lengths .
The pistons will work harmonically inside the engine due to their freely way of fixing them inside wheels with independent conducting feeding supply. This is regarding an important physical concept(a rotating object will need less power to keep on in its dynamic move or even acceleration it, than that primer power used first to change its static to dynamic mode as a relation proportioned inversely with its rotation speed)
This in considering all data, type of fuel, and situation of engine in various loading.

(1-2)- For the interrogation on how the aerodynamic effect is existing from exhaust gases by using specific outlet opening . (Ref. page 5 in the action).
It is by applying that fundamental concept of (Bernoulli's principle) and escaping balloon principle as essentially used to produce aerodynamic force in any rocket!.

The chamber(s) in the wheel is to be assumed as a rocket's chamber that contains pressured gases emissions(from fuel burnt) to expel from a rocket back side via a designed outlet (opening). This would be guarded be wings to change diameter or the angler direction of this opening to effect on escaping gases to control speed or direction of this rocket(same control has been used in advanced fighter air-jet). The same thing is applied (relatively) on graded specific exhaust openings fixed on the Case around the wheels periphery at starting exhaust portions of this engine. That is to construct affixed wings (or moveable by control) on the Case periphery around the wheels at a starting of exhaust zone to inverse the aerodynamic effect. These out lets which shaped by fixed wings will utilise the exhaust energy power. Since chamber(s) in this rotating wheel is containing pressured gases due to the previous explosion of air-fuel mixture (occurred before by spark) besides existence of Back Off force from the depressed (mode) elastic spring which is fixed beneath the piston to react, but in dual opposite directions ; on piston and cylinder base in the wheel to react also when chamber pressure starts to reduce at gas penetration. The place of these openings in Case starting where exhaust gases are free to expel. The openings orifices, angles, (wings shapes) and the places all will subjected to a plant aerodynamic design to act intensively at the exhaust zone outlets considering all other data e.g. the dimensions cylinder, the wheel, back off elastic springs , the fuel mixture compression ratio with the whole engine design and its loading. The chamber structure will be under escaping balloon concept same that used for a rocket; to be reflected then to act on its rotating wheel to add more power, more torque on engine output freely since the design provides this unique ability. This explained how the aerodynamic force of the exhaust gases could be utilised to add more power over the conventional fuel combustion power on output directly. The simplest example is the (rolling Fire Works wheel) rotates by reactions of these Fire Works mounted on the wheel periphery and so by using this principle. Exhaust central outlets placed to face the chambers and to be under the effect of aerodynamic exhaust gases when expelled from the chambers by a design starting (with rotating direction) by a small opening of sharp designed angle on its wheel tangent on the inner wall of wheel Case then followed by others in plant distances with gradually increasing in their diameter and/or in a tangent angle around the wheel periphery, in the beginning of exhaust zone; to have actual dual effect. First, increasing the speed of expelled gases (via small holes) to produce reflecting aerodynamic force acting positively on wheel. While changing the direction effect during the wheel rotation by positions change of outlet holes and angles. As to inverse a centrifugal turbine principle, when there is rotating periphery has plant wings surrounding its inner space with a pressured air comes via a pipe to be urged to drive outwardly in diagonal certain direction crossing these wings. The fast air will act on these wings while discharging out ; aerodynamically forcing the wings to move rotating the whole periphery on the same direction !. How about these wings are in affixed periphery as the Case of this engine, and the puffing device is able to rotate by a reaction , then it will rotate, same as the inner freely rotating wheel, containing chamber(s) of exhaust pressured gases urged to expel but aerodynamically to force the wheel to rotate. (Enc. page 120 in Ad. L. Phys.) How specific is this movement !? That is depending on how to exist and invest this phenomena in a design subjected to the whole mathematics calculation of the above mentioned data (by using computer formatting programmes !) .

(1-3)- The interrogation about the engine performance as combination of piston, rotary and turbine with additional influence of physical positive effect due to movement of elements inside the engine. (Ref. page 6 in the action).
This design includes fundamental physical concept those which used in inversely proportion with an available factor in any engine that is the 'speed' to have some Kinetic energies acting in a particular combined physical criteria to be utilised for the benefit of the engine output depending on conducting way of this system. By employing Newton's Laws of Motion, Gravitation and Centrifugal concepts to be implemented in this engine design same as used in astronomy's legends. The piston and its chamber (actual piston cup mass) are placed in the open side of a cylinder in the wheel(s) near the circumference. This cylinder(s) is placed in a position to have an axis making a wide angle with its wheel tangent to let a use of centrifugal influence to employ its resultant effectively by choosing an angle larger than 45°. The piston(s) will be under the effect of combustion force rotating the wheel, in the same time at high speed to be assumed as an attraction force on the piston(s) which is moving in this circular zone of wheel(s) periphery directing to its central axis, while the elastic push- arm beneath piston(s) urging to push it outwardly by transferring the centrifugal effect of the wheel fast rotating on the objects placed on its circular zone. The rotation speed producing this centrifugal effect which is as known will proportion inversely with the opposite force as it is here the combustion force (attraction force to the inner zone) on piston(s) which is consecutively occurred in the chamber(s). The force of pressured emission will laterally reflect any force acting outwardly on its flexible piston according to the concept of how pressured balloon could reflect a force (by gas elasticity) back on the same direction i.e. on the piston again. But since each chamber(s) is mounted on centre side place of the wheel the final resultant will act on the wheel rotation by accessing additional moment on it. As the angle of the cylinder is considered. That means also the actual expansion of chamber space will be deducted besides that concept of urging to balance the positions (as flexible) for all bodies which are mounted on opposite direction round a wheel in fast rotation, although there will be certain force to keep the wheel in rotation but as minimum as required. This means a deduction in said required internal combustion force in highly speeds or a rapid acceleration i.e. deduction in fuel consumption as if compared by the conventional systems . (Enc. Pages 82, 84 , 86 , 102 in Adv. Level Physics).
How to use this combined physical criteria is by substituting relevant determined data of the engine design and specification of fuel used to built the mathematical equations to observe practically the certain magnitude rate of magnifying the fuel energy on the output of the engine for a said fuel by physically utilising specific movements of elements inside this system as declared above .
(Enc. Pages 22,23, 36, 37, 62,63, 64, 65, 66 67, 68, 69. Advanced. Level physics 3rd Ed.).
The legends of the fundamental principles used in producing potential powers in this system have been explained on pages 20, 21, 23, 24 as general guiding lines. The above explanation has substituted some paragraphs now as market up on the same mentioned pages in the enclosure plant 2nd application as for your request.

(1-4) The request from the applicant to engage a third part unbiased and disinterested to provide USP with affidavits on this affair. (Ref. page 8 in the action).
The principal of this issue as to be done by the applicant is seemed inconvenient to be legitimate for any body, since if this would be done, many interrogations on

the kind of benefit or interest between that affidavits part and the applicant.
Any way the applicant could not agree to disclose this application to a third part
without a legal COFIDENTIAL PROTECTION WAVER for protection purpose and no
one would have to use this waver without expecting a sort of benefits from it.
* Please use your authority as Federal Patent Office to issue this affidavits officially
and directly from any good scientific institution by your choice in your legal way
of disclosing the plant application, since this mission will be justified as neutrally
only when it will issue by the patent office according to its legal authorisations.
This is a quite regular process for a patent office to issues classified consultations
when scientific arguments appeared on an invention that is for protecting its new
intellectuality and its claims legally while other parts participating on analysing
this affair specifically until a decision for inquiring a patent may obtained later on .
I may suggest to issue this affidavits officially by your side from FORD Company
since it had received a primer edition of this application within a legal 'waver',
and this company had its good reputation by its historical collaboration in official
US projects ,(Enc. Letter) or you may choose NASA or any good university.
Of course the results of this mission should be subjected indeed to publication.
This is my approval agreement in advance on this mission to be done by your
choice no matter how much time it may take under your supervision .
The request to submit a working model , I'm trying to contact some of those
who could fabricate a prototype in US within a deal but this mission may take
longer time to be accomplished not just in a few months.
In fact I had fabricated a primer working prototype in simple specifications in my
workshop five years ago. But unfortunately I could not even have to think about
bringing it to your office for the risk of doing that now in this unreasonable long
term situations knowing that my prototype is where I used to live in... Baghdad !.

2- Rejection of claim 1 as being anticipated by cited documents however they were
inoperative devices . (Ref. pages 8, 9 on the action).
Those mentioned cited documents have never been listed in my Int. Searching Rt.
Those four cited documents had got their chances to be registered and published
despite of being joined by the word 'inoperative' to describe them, also they
were in some how seemed to be anticipating by each other with many defects .
I tried to figure the cause of this rejection of my first 'independent' claim which
is seated to be essential in order to assure a protection of the industrial design,
the drawings copy rights protection and the basic technology on this performance
with legends of conducting this system as it is using new theories.
Despite of finding some parts in this design were happened to be used in previous
designs, but those parts as mentioned are technically not similar to the parts used
in this design, however those parts had been used in devices cited as inoperative!.
I don't think this could bend the whole described design to be rejected, without
considering the actual legends of the performance stages and how to conduct it
i.e. the management of this system the ways of overcoming the defects which had
appeared in those old cited documents in which had made them inoperative.
So for these reasons and according to that quotation 35 U. S. C. .101(on page 6)
(whoever invents or ..composition of matter, or useful improvement thereof, may
obtain a patent therefor, subjected to the conditions and requirements of this title)
as this is clear in recognising the presumption of existing a partial anticipation .
But the precise comparisons will clearly distinguish between this application and

those cited documents, to change a wrong believe of the total anticipation that made the rejection on the first essential independent claim . A claim describing the whole mechanical parts and its technical merits which explained clearly by the followed dependent claims in order to distinguish this engine from other devices. The roughly comparison and dissimilarity with Hay Patent No, GB 349614 are :

A- Hay's device was inoperative since it had neglected to consider the physical effects.

X- This is an operative device since it has considering all the physical effects these which appeared from a device depending mainly on circular shape criteria.

B- There was a stator and a rotor therein with a film lubricating medium between them .

X- There is a Case (casing *not stator*) containing tunnels for oil and cooling services and seals are mounted therein, with wheel(s) to rotate inside *without using film of lubricating medium,* there are cooling pads surrounding each wheel in the engine.

C- There is no way to expel the whole exhaust gases out of the chambers .

X- There is air puffing directed on the chambers at the end of exhaust zone to expel all emission and let pure air scavenging , cleaning , cooling the chambers and treating pollution in this engine with a control.

D- The management of the engine services was inefficient and clearly not practical .

X - The management of engine services is operatively perfect in this engine.

E- The conducting and feeding were failed as depending only on engine mechanism.

X- The conducting is independent from engine activities by considering the physical inverse potential criteria appeared with high speed and usefully overcoming it.

F- The isolation of stroke mode in chambers was unclear and seemed not effective.

X- There is clear isolating for stroke mode in chambers to be efficient in this engine.

G- The use of bladed turbine as had mentioned in page 5 line 1-27 did not mean using of direct exhaust aerodynamic influence on the pistons to work as a turbine.

X- The aerodynamic effect of gases has a direct influence on pistons i.e. on a wheel by the specific opening at exhaust zone to act on pistons to be as a turbine engine.

H- The feeding was limited or failed as using dependable parts on engine emissions.

X- The feeding of fuel mixture is relatively unlimited even in supercharging fuel mode providing wide power ranges on the pistons flexible design permits this ability in any circumstances even on each power unit independently in this engine.

I- The performance is limited as related only on mechanism vision of the engine parts.

X- The performance is in highly efficiency and unlimited to engine activities by a design utilising a combination of different physical concepts gathered to provide additional potential power benefits on engine output and a perfect independent conducting verities which is suitable for a computer formatting control and more else to add....

However there is one description for some parts in used but the important on how these parts employed inside a new operative device to judge any anticipation .+++

In summary the 2nd part reply contains :

1- Scientific interrogations as they have been declared regarding some references and for proposal to have classified affidavits, to be requested directly by USP under its choice from any third unbiased scientific institution .

2- The matter of uncertain believe of anticipation and rejecting of essential claim . With my appreciation ... to have USP conclusions in your next actions at your convenient time .. I remain sincerely .

Thank you.   Yours Faithfully

Shirwan AL PASHA AL BARHDAINI

Enc. :- *1st part of this letter*
A complete plant application 2nd Ed. & 25Drwg. + market up documents +References

Shirwan AL PASHA AL BAHDAINI
28 Av. Pictet de Rochemont
CH-1207 Geneva - SWITZERLAND
Tel-Fax : + 41 22 736 07 48
SHIRWO SYSTEM // Int. App.   PCT/ IB 99/ 00178
USPTO :   Serial No,   Cnfrm. No,   Filing Date
09/ 582, 634

US PATENT AND TRADEMARK OFFICE
Commissioner for Patents
Washington , DC 20231

GENEVA on **10 Apr., 02**

Mr. Thomas DENION
                    SUPERVISORY EXAMINER
     Dear Sir,

Sub. / a lost letter

Thank you for your letter dated 25-26 March, 2002 informing about the non delivery
of my R-letter dated on 18 Sep 2001 which mailed on 19 Sep, 2001 holding USPTO
address & the backside holding my address with a sealed serial No, 09/582, 634.

when recognising the important documents enclosed in that grand yellow envelope
(the whole plant application of a patent and documents in about 90 pages)   and the
situation at that time when the mail was checking by different resources, this letter
may be gone to other reference.
Any way I'm leaving this matter to your vision since it is concerning USP application
and its confidential information besides the receipt had returned back from US mail.

At the day I received your letter, I have inquired the official action from my local post
office which will declare this matter with US mail (who secured a registered delivery)
supported by the evidence .
Please do not save any effort to look for this letter by your ways and I will be much
obliged to have it returned back to me by your office or from US mail .
You may find attached a copy of the returning post receipt from US mail .

The application and whole relevant documents are resubmitted again as for your
request a company this letter.
Please consider this recent resubmitting letter on 1st action of USP as the only liable
letter until this date.
Hopefully this application will take its normal processing time program concerning
that unexpected incident happened few months ago with my approval for any time
extension on this application as it deserves indeed.

With my appreciation I remain .

                              Yours truly

                    Shirwan AL PASHA AL BAHDAINI
                              civil Engineer

Enc. Mail document. + reply letter on action in 100 pages.

Fax message / 4 pages

From / Shirwan AL PASHA AL BAHDAINI
28 Av. Pictet de Rochemont
CH-1207 Geneva - SWITZERLAND
Tel-Fax : + 41 22 736 07 48
SHIRWO SYSTEM // Int. App. PCT/ IB 99/ 00178
USPTO : <u>Serial No, Cnfrm. No, Filing Date</u>
09/ 582, 634

TO /

US PATENT AND TRADEMARK OFFICE

Commissioner for Patents
Washington , DC 20231

GENEVA on 28 Sep. 01

<u>ATT</u>: Mr. Thomas DENION   Fax : 001 703 308 7763

SUPERVISORY EXAMINER

Dear Sir,

1/.
Would you please recommend to check the arrival of my reply on your 1st action

which was mailed registered on 19-Sep. to USPTO as it would be shown.

Since this letter will normally take six days to reach your office, but regarding to the

recent circumstances, a probable delay in the mail may occur in your region which

needs to be considered.

2/.
Please find 3 documents to accompany the material of this mentioned letter :

A- Form (PTO 948) to amend the drawings as according to, which have been done.

B- Certificate in 2 letters from a well known US company to assure receiving of the

fundamental legends of this application legally, as it may be a choice for the matter

of affidavits to be issued directly by your authorisation (using the recent edition).

Thank you with best regards

Yours truly

Shirwan AL PASHA AL BAHDAINI

Enc. 3 documents.
Note : Please write my address (Street No, area code , city and the country) completely for your
correspondence.
* Please use this Fax for any urgent requirement

P.2

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USP. 09/582,634

Shirwan AL PASHA AL BAHDAINI
28 Av. Pictet de Rochemont
CH-1207 Geneva - SWITZERLAND
Tele/Fax : 00 41 - 22 - 736 07 48

// International Application PCT/ IB 99/ 00178

USPTO :	Serial No,	Cnfrm. No,	Filing Date
SHIRWO SYSTEM	09/ 582, 634	5682	13-SEP-00

US PATENT AND TRADEMARK OFFICE
Washington , DC 20231
Assistant Commissioner For patent
Office of Initial Patent Examination
Customer Service Centre

Geneva on   01- May, 2001

Sub / Addressing Plant App. PCT/ IB 99/ 00178 to USPTO

Gentlemen , The examiner(s).
Dear , M/s.
Please find enclosure the whole documents for the plant edition of above application
addressed to USPTO to be the relevant reliable plant application for your office *.
(Application documents of 46 pages of the text matter & 25 pages of the drawings)
A total of 71 pages of plant application PCT/IB99/00178 to USPTO .

This plant edition has little amendments on the previous international application without
changing in the essential features or in original drawings.
The amendments were, in adding more precise words for prescriptions, re-ordering the
text content, adding details No, 41 & No, 42 on the drawings, Abstract in more declaration
with adding details figures to prescribe the engine and then the claims in 30 points.

In the other hand, concerning the notification of your office for the voluntary request of
publishing a plant application, this is to express my request to your office for publishing
my plant application according to your (EFS) requirements.

Would you please start this mission in you nearest convenient time, however I would
prefer to put the last word on this affair in the hand of the examiner(s) after a review on
this application whether this invention needs more consultation from other references.

Please send to me the information for publishing and paying the fees for this application.

Thank you with my appreciation ... I remain .
 Best regards and respect

Yours Truly
Shirwan AL PASHA AL BAHDAINI

* *Referring to my previous letter dated on 02 Feb , 2001 (copy enclosure)*
Enc./ + Plant App. to USPTO - text in 46 pages +25 drawings.
          + Additional premier 15 drawings in coloured declarations for the examiner(s) in
            separate package for handling, drawings No, (1,2,3,4,5,8,9,10,13,17,19,22,23,24,25).
  Note //   Please record and use my new address at the present, mentioned above.
  Copy to /.
          Mr. Paul A Bell - USPTO - PCT Operations - for the same information please.

Sent on its date

Shirwan AL PASHA AL BAHDAINI
28 Av. Pictet de Rochemont
CH-1207 Geneva - SWITZERLAND
Fax C/o: 0041 22 304 43 59

// International Application PCT/ IB 99/ 00178

USPTO :	Serial No,	Cnfrm. No,	Filing Date
SHIRWO SYSTEM	09/ 582, 634	5682	13-SEP-00

US PATENT AND TRADEMARK OFFICE
Washington , DC 20231
Assistant Commissioner For patent
Office of Initial Patent Examination
Customer Service Centre   _Geneva on   02-Feb. 2001_

Sub./ Demand for : declarations on the publishing procedure,
and time program to assess this application

Gentlemen:
According to your latest notification concerning the confirmation number assignment,

possibility of publishing a plant applications submitted to USPTO and the processing .

Would you please supply me with the fee charges, the particular requirements and the

time schedules for these missions, or that 1239 Off. Gaz. Pat. mentioned in your letter .

Meanwhile if it is possible, could you please supply me with the programmed time to

start the examination on this application, that is because some more specific amendments

need to be added, recently, on the final plant application, before start the processing.

However these amendments are additional declarations and more specific options

without changing the initial principles of the claims or the drawings of this applications.

Thank you and awaiting for your reply ... I remain .

Best regards and respect

Truly Yours

Shirwan ALPASHA ALBAHDAINI

Copy to / :
• Mr. Paul A. Bell /
USPTO - PCT Operations (Commissioner for Patents) ; for the same purpose please.

If h is in metres, $\rho = 1000$ kg m^{-3} for water, $g = 9.8$ m s^{-2}, then, from $h =$

$$h = \frac{7.5 \times 10^3}{1000 \times 9.8} = 0.77 \text{ m (approx.)}.$$

The pressure head h is thus equivalent to 0.77 m of water.

Applications of Bernoulli's Principle

1. A suction effect is experienced by a person standing close to the platform at a station when a fast train passes. The fast-moving air between the person and train produces a decrease in pressure and the excess air pressure on the other side pushes the person towards the train.

Constriction

Tap

Air flow

High velocity low pressure

(i)
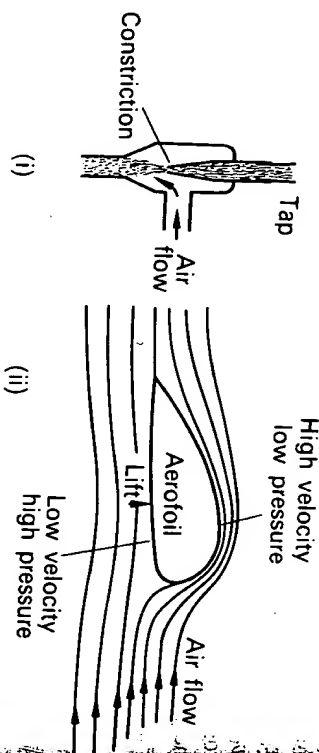
FIG. 4.25   Fluid velocity and pressure

Aerofoil

Lift

Low velocity high pressure

Air flow

(ii)

2. *Filter pump.* A filter pump has a narrow section in the middle, so that a jet of water from the tap flows faster here. Fig. 4.25 (i). This causes a drop in pressure near it and air therefore flows in from the side tube to which a vessel is connected. The air and water flows in from the side tube through the bottom of the filter pump.

3. *Aerofoil lift.* The curved shape of an aerofoil creates a faster flow of air over its top surface than the lower one. Fig. 4.25 (ii). This is shown by the closeness of the streamlines above the aerofoil compared with those below. From Bernoulli's principle, the pressure of the air below is greater than that above, and this produces the lift on the aerofoil.

4. *Flow of liquid from wide tank.* Suppose a liquid flows through a hole H at the bottom of a wide tank, as shown in Fig. 4.26. Assuming negligible viscosity and streamline flow at a small distance from the hole, which is an approximation, Bernoulli's theorem can be applied. At the top X of the liquid in the tank, the pressure is atmospheric, say B, the height measured from a fixed level such as the hole H is h, and the kinetic energy is negligible if the tank is wide so that the level falls very slowly. At the bottom, Y, near H, the pressure is again B, the height above H is now zero, and the kinetic energy is $\frac{1}{2}\rho v^2$, where ρ is the density and v is the
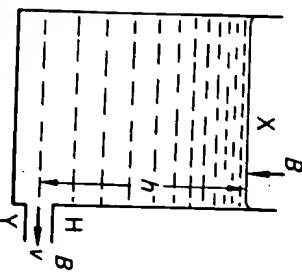
FIG. 4.26   Torricelli's theorem

X

B

h

H

B

v

Y

---

the velocity of the emergence of the liquid. Thus, from Bernoulli's Principle,

$$B + \rho g h = B + \frac{1}{2}\rho v^2$$

$$\therefore v^2 = 2gh$$

the velocity of the emerging liquid is the same as that which would be obtained if it fell freely through a height h, and this is known as *Torricelli's theorem*. In practice the velocity is less than that given by owing to viscous forces, and the lack of streamline flow must also be taken into account.

EXERCISES 4

What are the missing words in the statements 1–6?

1. In SI units, the moment or torque of a couple is measured in . . .

2. In laminar flow of non-viscous fluid along a pipe, at regions of high pressure is low.

Which of the following answers, A, B, C, D or E, do you consider is the correct one in the statements 8–10?

When an object is in equilibrium under the action of three non-parallel the three forces must . . . one point.

the component of a force F in a direction inclined to it at an angle θ is . . .

The sensitivity of a beam balance depends on the depth of the . . . below the

When an object floats, the weight of fluid displaced is equal to the . . .

stable equilibrium, when an object is slightly displaced its centre of is low.

When a cone is balanced on its apex on a horizontal table and then slightly displaced, the potential energy of the cone is then A increased, B decreased, constant, D a minimum, E a maximum.

If a hydrometer of mass 30 cm^3 has a graduated stem of and floats in water, the exposed length of stem is A 30 cm, B 25 cm, C 20 cm, 10 cm, E 1 cm.

A flat plate is cut in the shape of a square of side 200 cm, with an equilateral triangle of side 200 cm adjacent to the square. Calculate the distance of the centre of mass from the apex of the triangle.

In laminar flow of a non-viscous fluid along a horizontal pipe, the work done by the pressure at any section is equal to A the pressure, B the volume per second there, C pressure × volume per second there, D pressure × volume, E pressure × area of cross-section.

12. The foot of a uniform ladder is on a rough horizontal ground, and the top rests against a smooth vertical wall. The weight of the ladder is 40 kgf, and a man weighing 80 kgf stands on the ladder one-quarter of its length from the bottom. If the inclination of the ladder to the horizontal is 30°, find the reaction at the ground.

after deflection through an angle θ. Fig. 4.7 (ii). The forces F on the two sides X and Y of the coil are both equal to $BlIN$, where B is the strength of the magnetic field, l is the length of the coil and N is the number of turns (see Electricity section, chapter 35). Thus the coil is deflected by a couple. The moment or torque of the deflecting couple $= F \times b$, where $b = XY =$ breadth of coil. Hence

$$\text{torque} = BlIN \times b = BANI,$$

where $A = lb =$ area of coil. The opposing couple, due to the spring S, is $c\theta$, where c is its elastic constant (p.164). Thus, for equilibrium,

$$BANI = c\theta.$$

Work Done by a Couple

Suppose two equal and opposite forces F act tangentially to a wheel W, and rotate it through an angle θ while the forces keep tangentially to the wheel, Fig. 4.8. The moment of the couple is then constant.
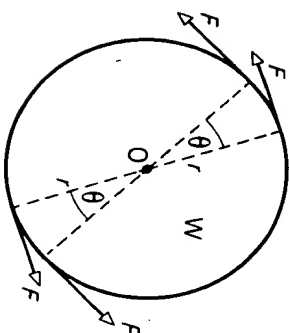

FIG. 4.8   Work done by couple

The work done by each force $= F \times$ distance $= F \times r\theta$, since $r\theta$ is the distance moved by a point on the rim if θ is in radians.

∴ total work done by couple $= Fr\theta + Fr\theta = 2Fr\theta$.

But moment of couple $= F \times 2r = 2Fr$.

∴ *work done by couple = torque or moment of couple $\times \theta$*

Although we have chosen a simple case, the result for the work done by a couple is always given by *torque $\times$ angle of rotation*. In the formula, it should be carefully noted that θ is in radians. Thus suppose $F = 100$ gf $= 0\cdot1$ kgf $= 0\cdot1 \times 9\cdot8$ newton, $r = 4$ cm $= 0\cdot04$ metre, and the wheel makes 5 revolutions while the moment of the couple is kept constant. Then

torque or moment of couple $= 0\cdot1 \times 9\cdot8 \times 0\cdot08$ newton metre,

and angle of rotation $= 2\pi \times 5$ radian.

∴ work done $= 0\cdot1 \times 9\cdot8 \times 0.08 \times 2\pi \times 5$ ...

Centre of Gravity

Every particle is attracted towards the centre of the earth by the force of gravity, and the *centre of gravity* of a body is the point where the resultant force of attraction or *weight* of the whole object acts. In the simple case of a ruler, the centre of gravity is the point of support when the ruler is balanced. A similar method can be used to find roughly the centre of gravity of a flat plate. A more accurate method consists of suspending the object in turn from two points on it, so that it hangs freely in each case, and finding the point of intersection of a plumb-line, suspended in turn from each point of suspension. This experiment is described in elementary books.

An object can be considered to consist of many small particles. The forces on the particles due to the attraction of the earth are all parallel since they act vertically, and hence their resultant is the sum of all the forces. The resultant is the *weight* of the whole object, of course. In the case of a rod of uniform cross-sectional area, the weight of a particle at one end, and that of a corresponding particle A' at the other end, have a resultant which acts at the mid-point O of the rod, Fig. 4.9 (i).
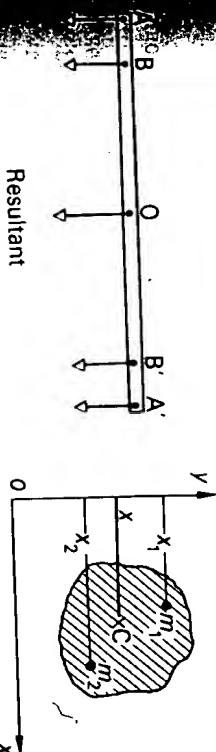

(i)

Resultant

(ii)

FIG. 4.9   Centre of gravity and mass

Similarly, the resultant of the weight of a particle B, and that of a corresponding particle at B', have a resultant acting at O. In this way, by symmetry, it follows that the resultant of the weights of all the particles of the rod acts at O. Hence the centre of gravity of a uniform rod is at its mid-point.

The centre of gravity, C.G., of the curved surface of a hollow cylinder acts at the midpoint of the cylinder axis. This is also the position of the C.G. of a uniform solid cylinder. The C.G. of a triangular plate or lamina is two-thirds of the distance along a median from corresponding point of the triangle. The C.G. of a uniform right solid cone is three-quarters along the axis from the apex.

Centre of Mass

The 'centre of mass' of an object is the point where its total mass acts or appears to act. Fig 4.9 (ii) illustrates how the position of the centre of mass of an object may be calculated, using axes Ox, Oy. If m_1 is the mass of a small part of the object and x_1 is the perpendi-

at first and then very sharply, Fig. 6.2 (i). Up to A, about 5 kgf, results show that the extension increased by 0·14 mm per kgf added to the wire. A, then, is the *proportional limit*. Along OA, and up to beyond A, the wire returned to its original length when the load removed. L is the *elastic limit*. Along OL the wire is said to undergo *elastic deformation*. Beyond L, however, the wire has a permanent OP when the stress is removed. Fig. 6.2 (ii). The reader should distinguish between the proportional limit A and the elastic limit L.
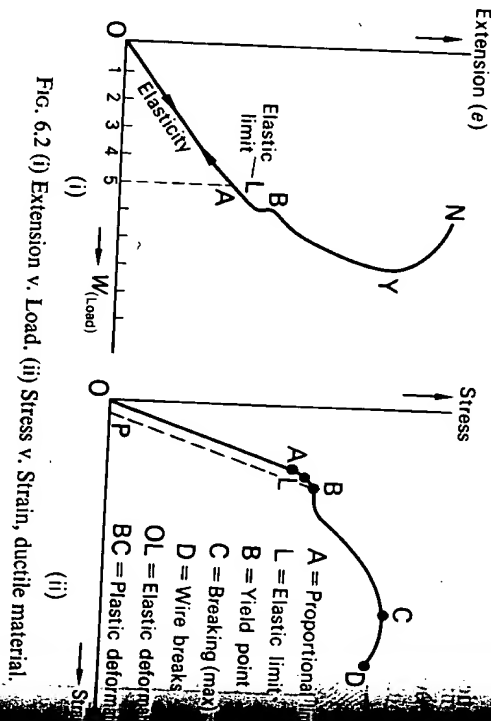

Fig. 6.2 (i) Extension v. Load. (ii) Stress v. Strain, ductile material.

A = Proportional limit
L = Elastic limit
B = Yield point
C = Breaking (max)
D = Wire breaks
OL = Elastic deformation
BC = Plastic deformation

Hooke's Law

From the straight line graph OA, we deduce that *the extension proportional to the load or tension in a wire if the proportional limit is exceeded*. This is known as *Hooke's law*, after ROBERT HOOKE, founder of the Royal Society, who discovered the relation in 1676. The law shows that when a molecule of a solid is slightly displaced from its mean position, the restoring force is proportional to its displacement (see p. 126). One may therefore conclude that the molecules of a solid are undergoing simple harmonic motion (p. 44).

The measurements also show that it would be dangerous to load the wire with weights greater than the magnitude of the elastic limit, because the wire then suffers a permanent strain. Similar experiments in the research laboratory enable scientists to find the maximum load which a steel bridge, for example, should carry for safety. Rubber samples are also subjected to similar experiments, to find the maximum safe tension in rubber belts used in machinery.

Yield Point, Ductile and Brittle Substances. Breaking Stress

Careful experiments show that, for mild steel and iron for example the molecules of the wire begin to 'slide' across each other soon after the load exceeds the elastic limit, that is, the material becomes *plastic*. This is indicated by the slight 'kink' at B beyond L in Fig. 6.2 (i), and is called the *yield point* of the wire. The change from an elasticity

...shown by a sudden increase in the extension, and as ... increased further the extension increases rapidly along the ... the wire then snaps. The *breaking stress* of the wire is the ... force per unit area of cross-section of the wire. Sub... ... force per unit area of cross-section of the wire. Sub... as those just described, which elongate considerably and ... plastic deformation until they break, are known as *ductile* ... Lead, copper and wrought iron are ductile. Other sub... however, break just after the elastic limit is reached; they are ... brittle substances. Glass and high carbon steels are brittle.

... increase in length beyond the elastic limit as the load is ... without the appearance of a plastic stage.

... strength and ductility of a metal, its ability to flow, are dependent ... the metal crystal lattice. Such defects may consist of a ... from at a site or a *dislocation* at a plane of atoms. Plastic ... is the result of the 'slip' of atomic planes. The latter is ... movement of dislocations, which spreads across the crystal.

Stress and Tensile Strain. Young's Modulus

... now to consider the technical terms used in the subject of ... of wires. When a force or tension F is applied to the end of a cross-sectional area A, Fig. 6.3,

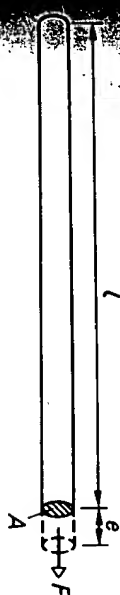Fig. 6.3 Tensile stress and tensile strain

the *tensile stress* = *force per unit area* = $\dfrac{F}{A}$ (1)

extension of the wire is e, and its original length is l,

the *tensile strain* = *extension per unit length* = $\dfrac{e}{l}$ (2)

... kg is attached to the end of a wire of length 2 metres of ... 0·64 mm, and the extension is 0·60 mm. Then

$$\text{tensile stress} = \frac{2 \times 9.8}{\pi \times 0.032^2 \times 10^{-4}} \text{ N m}^{-2},$$

$$2 \text{ kgf} = 2 \times 9.8 \text{ N}, \quad A = \pi \times 0.032^2 \text{ cm}^2 = \pi \times 0.032^2 \times 10^{-4} \text{ m}^2.$$

$$\text{tensile strain} = \frac{0.6 \times 10^{-3} \text{ metre}}{2 \text{ metre}} = 0.3 \times 10^{-3}.$$

... be noted that 'stress' has units such as 'N m⁻²; 'strain' has no ... because it is the ratio of two lengths.

But the area δA of the triangle SBO $= \frac{1}{2}$ base $\times$ height $= \delta s \times p/2$.

$$\therefore m.\frac{2\delta A}{\delta t} = \text{constant}$$

$$\therefore \frac{\delta A}{\delta t} = \text{constant},$$

since $2m$ is constant. Thus if the conservation of angular momentum is true, the area swept out per second by the radius SO is constant while the planet O moves in its orbit. In other words, equal areas are swept out in equal times. *But this is Kepler's second law*, which has been observed to be true for centuries (see p. 58). Consequently, the principle of the conservation of angular momentum has stood the test of time.

From the equality of the angular momentum values at O and C, where p is less than p_1, it follows that v is greater than v_1. Thus the planet speeds up on approaching S.

The force on O is always one of attraction towards S. It is described as a *central force*. Thus the force has no moment about O and hence the angular momentum of the planet about S is conserved.

Kinetic Energy of a Rolling Object

When an object such as a cylinder or ball rolls on a plane, the object is rotating as well as moving bodily along the plane; therefore it has rotational energy as well as translational energy.
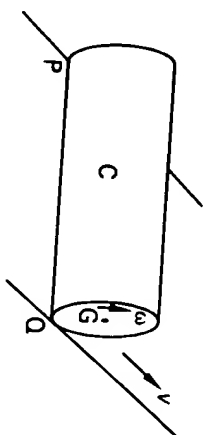

Fig. 3.13   Rolling object

Consider a cylinder C rolling along a plane without slipping, Fig. 3.13. At any instant the line of contact, PQ, with the plane is at rest, and we can consider the whole of the cylinder to be rotating about this axis. Hence the energy of the cylinder $= \frac{1}{2}I_1\omega^2$, where I_1 is the moment of inertia about PQ and ω is the angular velocity.

But if I is the moment of inertia about a parallel axis through the centre of gravity of the cylinder, M is the mass of the cylinder and a its radius, then

$$I_1 = I + Ma^2,$$

from the result on p. 79.

$$\therefore \text{energy of cylinder} = \frac{1}{2}(I + Ma^2)\omega^2$$
$$= \frac{1}{2}I\omega^2 + \frac{1}{2}Ma^2\omega^2$$

$$\therefore \text{Energy} = \frac{1}{2}I\omega^2 + \frac{1}{2}Mv^2 \qquad (1)$$

By considering the distance rolled and the angle then turned, $v =$ velocity of centre of gravity. This energy formula is true for any moving object.

As an application of the energy formula, suppose a *ring* rolls along a ... the velocity of the centre of gravity, ω, about its centre $= v/a$, ... the moment of inertia about the centre of gravity.

$$\therefore \text{kinetic energy of ring} = \frac{1}{2}Mv^2 + \frac{1}{2}I\omega^2$$
$$= \frac{1}{2}Mv^2 + \frac{1}{2}Ma^2 \times \left(\frac{v}{a}\right)^2 = Mv^2.$$

... similar reasoning, the kinetic energy of a sphere rolling down a plane
$$= \frac{1}{2}Mv^2 + \frac{1}{2}I\omega^2$$
$$= \frac{1}{2}Mv^2 + \frac{1}{2} \times \frac{2}{5}Ma^2 \times \left(\frac{v}{a}\right)^2 = \frac{7}{10}Mv^2,$$

since $I = 2Ma^2/5$ (p. 78).

Acceleration of Rolling Object

We can now deduce the acceleration of a rolling object down an inclined plane.

As an illustration, suppose a solid cylinder rolls down a plane. Then

$$\text{kinetic energy} = \frac{1}{2}Mv^2 + \frac{1}{2}I\omega^2.$$

... moment of inertia, I, about an axis through the centre of gravity parallel to the plane $= \frac{1}{2}Ma^2$, and $\omega = v/a$, where a is the radius.

$$\therefore \text{kinetic energy} = \frac{1}{2}Mv^2 + \frac{1}{4}Mv^2 = \frac{3}{4}Mv^2.$$

If the cylinder rolls from rest through a distance s, the loss of potential energy $= Mgs \sin \alpha$, where α is the inclination of the plane to the horizontal.

$$\therefore \frac{3}{4}Mv^2 = Mgs \sin \alpha$$
$$\therefore v^2 = \frac{4g}{3}s \sin \alpha$$

But $v^2 = 2as$, where a is the linear acceleration.

$$\therefore 2as = \frac{4g}{3}s \sin \alpha$$

$$\therefore a = \frac{2g}{3} \sin \alpha \qquad (i)$$

The acceleration if sliding and no rolling took place down the plane is $g \sin \alpha$. The cylinder has thus a smaller acceleration when rolling.

The time t taken to move through a distance s from rest is given by $s = \frac{1}{2}at^2$. Thus, from (i),

$$s = \frac{1}{3}gt^2 \sin \alpha,$$

$$\text{or} \quad t = \sqrt{\frac{3s}{g \sin \alpha}}.$$

Similarly, if a mass is dropped gently on to a turntable rotating freely at a steady speed, the conservation of angular momentum leads to a reduction in the speed of the table.

Angular momentum, and the principle of the conservation of angular momentum, have wide applications in physics. They are used in connection with enormous rotating masses such as the earth, as well as minute spinning particles such as electrons, neutrons and protons found inside atoms.

Experiment on Conservation of Angular Momentum

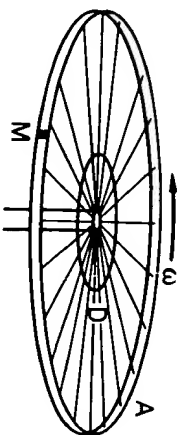A simple experiment on the principle of the conservation of angular momentum is illustrated below.

FIG. 3.10 Conservation of angular momentum

Briefly, in Fig. 3.10 (i) a bicycle wheel A without a tyre is set rotating in a horizontal plane and the time for three complete revolutions is obtained with the aid of a white tape marker M on the rim. A ring D of known moment of inertia, I, is then gently placed on the wheel concentric with it, by 'dropping' it from a small height. The time for the next three revolutions is then determined. This is repeated with several more rings of greater known moment of inertia.

If the principle of conservation of angular momentum is true, then $I_0\omega_0 = (I_0 + I_1)\omega_1$, where I_0 is the moment of inertia of the wheel alone, ω_0 is the angular frequency of the wheel alone, and ω_1 is the angular frequency with a ring. Thus if t_0, t_1 are the respective times for three revolutions,

$$\frac{I_0 + I_1}{t_1} = \frac{I_0}{t_0}$$

$$\therefore \frac{I_1}{I_0} + 1 = \frac{t_1}{t_0}$$

Thus a graph of t_1/t_0 v. I_1 should be a straight line. Within the limits of experimental error, this is found to be the case.

EXAMPLE

Consider a disc of mass 100 g and radius 10 cm is rotating freely about axis O through its centre at 40 r.p.m. Fig. 3.11. Then, about O,

moment of inertia $I = \frac{Ma^2}{2} = \frac{1}{2} \times 0.1 \text{ (kg)} \times 0.1^2 \text{ (m}^2) = 5 \times 10^{-4} \text{ kg m}^2$,

and angular momentum $= I\omega = 5 \times 10^{-4} \cdot \omega$,

where ω is the angular velocity

Similarly somewhat. W of mass m 20 g is dropped gently on to the disc at a ... 0.08 cm from the centre O. The disc then slows down to another speed, ...ding to an angular velocity ω_1 say. The total angular momentum of disc plus wax

$= 5 \times 10^{-4} \omega_1 + 0.02 \times 0.08^2 \cdot \omega_1$

the conservation of angular momentum
the disc and wax about O

$$6.28 \times 10^{-4} \omega_1 = 5 \times 10^{-4} \cdot \omega.$$

$$\frac{\omega_1}{\omega} = \frac{500}{628} = \frac{n}{40},$$

... is the r.p.m. of the disc.

$$\therefore n = \frac{500}{628} \times 40 = 32 \text{ (approx)}.$$

FIG. 3.11 Example.

Kepler's law and angular momentum

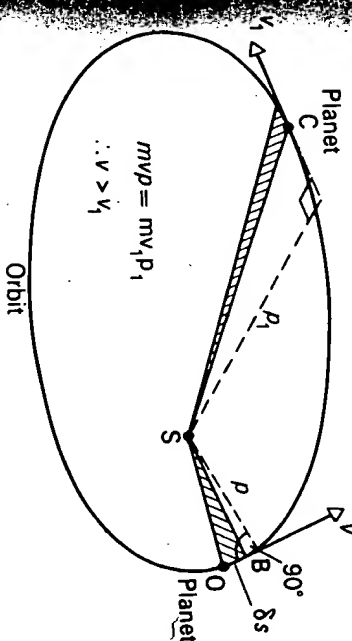Consider a planet moving in an orbit round the sun S. Fig. 3.12.

FIG. 3.12 Angular momentum and planets

At an instant when the planet is at O, its velocity v is along the tangent to the orbit at O. Suppose the planet moves a very small distance δs from O to B in a small time δt, so that the velocity $v = \delta s/\delta t$ and its direction is practically along OB. Then, if the conservation of angular momentum is obeyed,

$$mvp = mv_1p_1$$
$$\therefore v > v_1$$

there m is the mass of the planet and p is the perpendicular from S to OB produced.

$$mv \times p = \text{constant},$$

$$\therefore \frac{m \cdot \delta s \cdot p}{\delta t} = \text{constant}.$$

angular acceleration of the flywheel. What would be the acceleration if a mass of 2 kg were hung from the end of the rope? (O. & C.)

$$\text{Couple } C = I\frac{d^2\theta}{dt^2} = \text{moment of inertia} \times \text{angular}$$

acceleration.

Now $C = 2 \times 9.8 \times 0.1$ N m.

∴ angular acceleration $= \dfrac{2 \times 9.8 \times 0.1}{0.1}$

$= 19.6$ rad s^{-2}

If a mass of 2kg is hung from the end of the rope, it moves down with an acceleration a, Fig. 3.8. In this case, if T is the tension in the rope,

$$mg - T = ma \qquad . \quad (1)$$

Fig. 3.8   Example

For the flywheel,

$$T.r = \text{couple} = I\frac{d^2\theta}{dt^2} \qquad . \quad (2)$$

where r is the radius of the flywheel. Now the mass of 2 kg descends a distance given by $r\theta$, where θ is the angle the flywheel has turned. Hence the acceleration $a = rd^2\theta/dt^2$. Substituting in (1),

$$\therefore mg - T = mr\frac{d^2\theta}{dt^2}$$

$$\therefore mgr - T.r = mr^2\frac{d^2\theta}{dt^2} \qquad . \quad (3)$$

Adding (2) and (3),

$$\therefore mgr = (I + mr^2)\frac{d^2\theta}{dt^2}$$

$$\therefore \frac{d^2\theta}{dt^2} = \frac{mgr}{I + mr^2} = \frac{2 \times 10 \times 0.1}{0.1 + 2 \times 0.1^2}$$

$$= 16.7 \text{ rad s}^{-2}$$

using $g = 10$ m s^{-2}

Angular Momentum and Conservation

In linear or straight-line motion, an important property of a moving object is its linear momentum (p. 18). When an object spins or rotates about an axis, its *angular momentum* plays an important part in its motion.

Consider a particle A of a rigid object rotating about an axis O. Fig. 3.9 (i). The momentum of A = mass × velocity = $m_1v = m_1r_1\omega$. The 'angular momentum' of A about O is defined as the *moment of the momentum* about O. Its magnitude is thus $m_1v \times p$, where p is the perpendicular distance from O to the direction of v. Thus angular momentum of A $= m_1vp = m_1r_1\omega \times r_1 = m_1r_1^2\omega$.
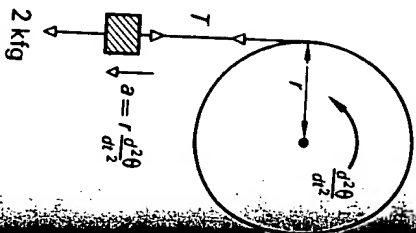
∴ angular momentum of whole body $= \Sigma m_1r_1^2\omega = \omega\Sigma m_1r_1^2$

$= I\omega$,

This is the moment of inertia of the body about O.

angular momentum is analogous to 'linear momentum', mv, in the ...ics of a moving particle. In place of m we have I, the moment of ...in place of v we have ω, the angular velocity.

...rther, the *conservation of angular momentum*, which corresponds ...he conservation of linear momentum, states that *the angular ...entum about an axis of a given rotating body or system of bodies is ...ce ...* if no external couple acts about that axis. Thus when a high ...umps from a diving board, his moment of inertia, I, can be ...eased by curling his body more, in which case his angular velocity ...increased Fig. 3.9 (ii). He may then be able to turn more somer- ...s before striking the water. Similarly, a dancer on skates can spin ...by folding her arms.
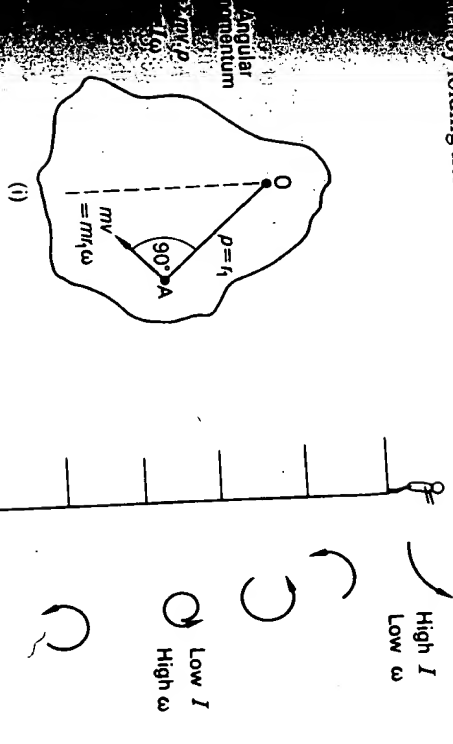

Fig. 3.9 · Angular momentum

The earth is an object which rotates about an axis passing through ...eographic north and south poles with a period of 1 day. If it is ...by meteorites, then, since action and reaction are equal, no ...al couple acts on the earth and meteorites. Their total angular ...momentum is thus conserved. Neglecting the angular momentum of the ...meteorites about the earth's axis before collision compared with that ...of the earth, then

angular momentum of *earth plus meteories after collision* = angular momentum of *earth before collision*.

Since the effective mass of the earth has increased after collision the ...of inertia has increased. Hence the earth will slow up slightly.

FORM PTO 948 (REV. 01-97)   U.S. DEPARTMENT OF COMMERCE-Patent and Trademark Office   Application No. 29/582639

NOTICE OF DRAFTPERSON'S
PATENT DRAWING REVIEW

Correction of Informalities (done)

The drawing filed (insert date) 5/7/01 are:

A. _____✓_____ not objected to by the Draftperson under 37 CFR 1.84 or 1.152.

B. _____✓_____ objected to by the Draftperson under 37 CFR 1.84 or 1.152 as indicated below. The Examiner will require submission of new, corrected drawings whe necessary. Corrected drawings must be submitted according to the instructions on the back of this notice.

1. DRAWINGS. 37 CFR 1.84(a): Acceptable categories of drawings:
Black ink. Color.
___✓___ Color drawing are not acceptable until petition is granted.
Fig.(s) 1,2 - 25
_____ Pencil and non black ink is not permitted. Fig(s)_____

2. PHOTOGRAPHS. 37 CFR 1.84(b)
_____ Photographs are not acceptable until petition is granted,
_____ 3 full-tone sets are required. Fig(s)_____
_____ Photographs not properly mounted (must brystol board or photographic double-weight paper). Fig(s)_____
_____ Poor quailty (half-tone). Fig(s)_____

3. TYPE OF PAPER. 37 CFR 1.84(e)
_____ Paper not flexible, strong, white and durable.
Fig.(s)_____
_____ Erasures, alterations, overwritings, interlineations, folds, copy machine marks not acceptable. (too thin)
_____ Mylar, vellum paper is not acceptable (too thin).
Fig(s)_____

4. SIZE OF PAPER. 37 CFR 1.84(F): Acceptable sizes:
_____ 21.0 cm by 29.7 cm (DIN size A4)
_____ 21.6 cm by 27.9 cm (8 1/2 x 11 inches)
_____ All drawings sheets not the same size.
Sheet(s)_____

5. MARGINS. 37 CFR 18.4(g): Acceptable margins:
Top 2.5 cm Left 2.5 cm Right 1.5 cm Bottom 1.0 cm
SIZE: A4 Size
Top 2.5 cm Left 2.5 cm Right 1.5 cm Bottom 1.0 cm
SIZE: 8 1/2 x 11
___✓___ Margins not acceptable. Fig(s) 1A, 2B, 3B 10, 12
___✓___ Top (T) ___✓___ Left (L)
_____ Right (R) _____ Bottom (B) 13A, 13B 14, 19
21 22 23
6. VIEWS. CFR 1.84(h)
REMINDER: Specification may require revision to correspond to drawing changes.
_____ Views connected by projection lines or lead lines.
Fig.(s)_____   25A
25B
Partial views. 37 CFR 1.84(h)(2)
_____ Brackets needed to show figure as one entity.
Fig.(s)_____
___✓___ Views not labeled separately or properly.
Fig.(s) 1 - 25   1 - 25 color drawings
_____ Enlarged view not labeled separately or properly.
Fig.(s)_____

7. SECTIONAL VIEWS. 37 CFR 1.84(h)(3)
_____ Hatching not indicated for sectional portions of an object.
Fig.(s)_____
_____ Sectional designation should be noted with Arabic or Roman numbers. Fig.(s)_____

8. ARRANGEMENT OF VIEWS. 37 CFR 1.84(i)
_____ Words do not appear on a horizontal, left-to-right fashion when page is either upright or turned, so that the top becomes the right side, except for graphs. Fig.(s)_____
_____ Views not on the same plane on drawing sheet. Fig.(s)_____

9. SCALE. 37 CFR 1.84(k)
_____ Scale not large enough to show mechansim with crowding when drawing is reduced in size to two-thirds in reproduction. Fig.(s)_____

10. CHARACTER OF LINES, NUMBERS, & LETTERS. 37 CFR 1.84(l)
___✓___ Lines, numbers & letters not uniformly thick and well defined, clean, durable and black (poor line quality).
Fig.(s) 2 - 5   8 9F 16, 17

11. SHADING. 37 CFR 1.84(m)
_____ Solid black areas pale. Fig.(s)_____
_____ Solid black shading not permitted. Fig.(s)_____
_____ Shade lines, pale, rough and blurred. Fig.(s)

12. NUMBERS, LETTERS, & REFERENCE CHARACTERS. 37 CFR 1.48(p)
___✓___ Numbers and reference characters not plain and legible.
Fig.(s) 2 - 4
___✓___ Figure legends are poor. Fig.(s) All
_____ Numbers and reference characters not oriented in the same direction as the view. 37 CFR 1.84(p)(3) Fig.(s)_____
_____ Engligh alphabet not used. 37 CFR 1.84(p)(3) Fig.(s)_____
_____ Numbers, letters and reference characters must be at least .32 cm (1/8 inch) in height. 37 CFR 1.84(p)(3) Fig.(s)_____

13. LEAD LINES. 37 CFR 1.84(q)
_____ Lead lines cross each other. Fig.(s)_____
_____ Lead lines missing. Fig.(s)_____

14. NUMBERING OF SHEETS OF DRAWINGS. 37 CFR 1.48(t)
_____ Sheets not numbered consecutively, and in Ababic numerals beginning with number 1. Fig.(s)_____

15. NUMBERING OF VIEWS. 37 CFR 1.84(u)
___✓___ Views not numbered consecutively, and in Abrabic numerals, beginning with number 1. Fig.(s)_____

16. CORRECTIONS. 37 CFR 1.84(w)
_____ Corrections not made from PTO-948 dated_____

17. DESIGN DRAWINGS. 37 CFR 1.152
_____ Surface shading shown not appropriate. Fig.(s)_____
_____ Solid black shading not used for color contrast. Fig.(s)_____

Confirmed

Amendments are done and Sent on 12 Apr. 2002 2nd envoy.

COMMENTS   *Remove border lines 1 - 25*

Ford Motor Company

Ford Global Technologies, Inc.
A Subsidiary of Ford Motor Company
Consumer Innovation Office

P.O. Box 6234
Dearborn, MI 48121-6234

Shirwan Al Pasha Al Bahdaini
Rue David-Dufour 8
Geneva, Geneve Ch-1205
SWITZERLAND

Wednesday, September 06, 2000

ND No: **5071**

Dear Shirwan Al Pasha Al Bahdaini:

Your suggestion to Ford Motor Company is included in Volume 1, Issue 4 of a consolidated report that is distributed to hundreds of Ford Technical Specialists. These specialists evaluate ideas for possible implementation in Ford products. Their evaluation is based on two major elements, improvement upon current technology and cost. If your suggestion meets these requirements, Ford specialists will contact you for further information and analysis.

We appreciate your input and enthusiasm. Ford is committed to reviewing new ideas and technology from external sources to provide the best possible products and services to consumers.

Thank you for your support of Ford Motor Company.

Sincerely,

Al Leshan

A.C. Leshan
Manager, Consumer Innovation Office

For USP. 09/582634

12 Apr. 2002

where M is the mass of the earth. Suppose g' is the acceleration due to gravity at the radius b. Then, from above,

$$mg' = \frac{GmM'}{b^2} = \frac{GmMb}{r^3}.$$

Since $GM/r^2 = g$, it follows by substitution that

$$g' = \frac{b}{r}g.$$

Thus assuming a uniform density of core, which is not the case in practice, the acceleration due to gravity g' is directly proportional to the distance from the centre. Fig. 2.25.

If the depth below the earth's surface is h, then $b = r - h$.

$$\therefore g' = \left(\frac{r-h}{r}\right)g = \left(1 - \frac{h}{r}\right)g \qquad . \qquad . \qquad (2)$$

Comparing (1) and (2), it can be seen that the acceleration at a distance h below the earth's surface is *greater* than at the same distance h above the earth's surface.

Potential

The *potential*, V, at a point due to the gravitational field of the earth is defined as numerically equal to the work done in taking a unit mass from infinity to that point. This is analogous to 'electric potential.' The potential at infinity is conventionally taken as *zero*.

For a point outside the earth, assumed spherical, we can imagine the whole mass M of the earth concentrated at its centre. The force of attraction on a unit mass outside the earth is thus GM/r^2, where r is the distance from the centre. The work done by the gravitational force in moving a distance δr towards the centre = force×distance = $GM.\delta r/r^2$. Hence the potential at a point distant a from the centre is given by

$$V_a = \int_\infty^a \frac{GM}{r^2}dr = -\frac{GM}{a} \qquad . \qquad . \qquad (1)$$

if the potential at infinity is taken as zero by convention. The negative sign indicates that the potential at infinity (zero) is *higher* than the potential close to the earth.

On the earth's surface, of radius r, we therefore obtain

$$V = -\frac{GM}{r} \qquad . \qquad . \qquad . \qquad (2)$$

Velocity of Escape. Suppose a rocket of mass m is fired from the earth's surface Q so that it just escapes from the gravitational influence of the earth. Then

work done = $m\times$potential difference between infinity and Q.

$$\therefore \text{kinetic energy of rocket} = \tfrac{1}{2}mv^2 = m\times\frac{GM}{r}.$$

$$= m\times\frac{GM}{r}.$$

$$\therefore v = \sqrt{\frac{2GM}{r}} = \text{velocity of escape}.$$

Now

$$GM/r^2 = g.$$

$$\therefore v = \sqrt{2gr}.$$

$$v = \sqrt{2\times9.8\times6.4\times10^6} = 11\times10^3 \text{ m s}^{-1} = 11 \text{ km s}^{-1}\text{(approx)}.$$

With an initial velocity, then, of about 11 km s⁻¹, a rocket will completely escape from the gravitational attraction of the earth. It can be made to travel towards the moon, for example, so that eventually it comes under the gravitational attraction of this planet. At present, 'soft' landings on the moon have been made by firing retarding retro rockets.
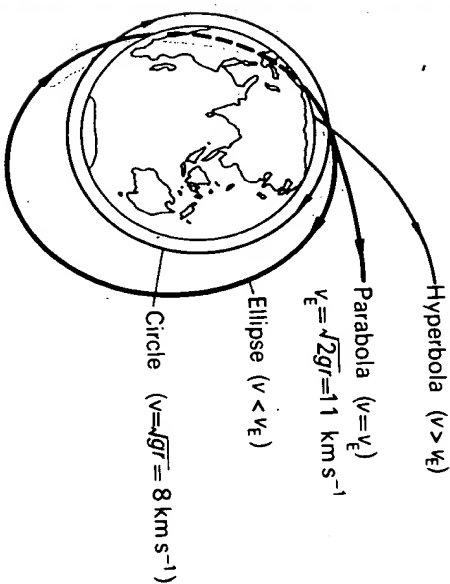

Fig. 2.26 Orbits

Hyperbola ($v > v_E$)

Parabola ($v = v_E$)

$v_E = \sqrt{2gr} = 11$ km s⁻¹

Ellipse ($v < v_E$)

Circle ($v = \sqrt{gr} = 8$ km s⁻¹)

Summarising, with a velocity of about 8 km s⁻¹, a satellite can describe a circular orbit close to the earth's surface (p. 64). With a velocity greater than 8 km s⁻¹ but less than 11 km s⁻¹, a satellite describes an elliptical orbit round the earth. Its maximum and minimum height in the orbit depends on its particular velocity. Fig. 2.26 illustrates the possible orbits of a satellite launched from the earth.

The molecules of air at normal temperatures and pressures have an average velocity of the order of 480 m s⁻¹ or 0.48 km s⁻¹ which is much less than the velocity of escape. Many molecules move with higher velocity than 0.48 km s⁻¹ but gravitational attraction keeps the atmosphere round the earth. The gravitational attraction of the moon is much less than that of the earth and this accounts for the lack of atmosphere round the moon.

EXERCISES 2
(Assume $g = 10$ m s⁻²)

What are the missing words in the statements 1–6?

1. The force towards the centre in circular motion is called the . . . force.

2. In simple harmonic motion, the maximum kinetic energy occurs at the . . .

ADVANCED LEVEL PHYSICS

where g is the acceleration due to gravity outside the spacecraft at the particular height of the orbit. Fig. 2.23 (ii). If S' is the reaction of the surface of the spacecraft in contact with the astronaut, then, for circular motion,

$$F = mg' - S' = ma = mg'.$$

Thus $S' = 0$. Consequently the astronaut becomes 'weightless'; he experiences no reaction at the floor when he walks about, for example. At the earth's surface we feel the reaction at the ground and are thus conscious of our weight. Inside a lift which is falling fast, the reaction at our feet diminishes. If the lift falls freely, the acceleration of objects inside is the same as that outside and hence the reaction on them is zero. This produces the sensation of 'weightlessness'. In orbit, as in Fig. 2.23 (ii), objects inside a spacecraft are also in 'free fall' because they have the same acceleration g' as the spacecraft. Consequently the sensation of weightlessness is experienced.

EXAMPLE

A satellite is to be put into orbit 500 km above the earth's surface. If its vertical velocity after launching is 2000 m s^{-1} at this height, calculate the magnitude and direction of the impulse required to put the satellite directly into orbit, if its mass is 50 kg. Assume $g = 10$ m s^{-2}; radius of earth, $R = 6400$ km.

Suppose u is the velocity required for orbit, radius r. Then, with usual notation,

$$\frac{mu^2}{r} = \frac{GmM}{r^2} = \frac{gR^2m}{r^2}, \text{ as } \frac{GM}{R^2} = g.$$

$$\therefore u^2 = \frac{gR^2}{r}.$$

Now $R = 6400$ km, $r = 6900$ km, $g = 10$ m s^{-2}.

$$\therefore u^2 = \frac{10 \times (6400 \times 10^3)^2}{6900 \times 10^3}.$$

$$\therefore u = 7700 \text{ m s}^{-1} \text{ (approx.)}.$$

At this height, vertical momentum

$$U_y = mv = 50 \times 2000 = 100000 \text{ kg m s}^{-1}$$

Fig. 2.24.

Horizontal momentum required $U_x = mu = 50 \times 7700 = 385\,000$ kg m s^{-1}

∴ impulse needed, $U_r = \sqrt{U_y{}^2 + U_x{}^2} = \sqrt{100\,000^2 + 385\,000^2}$

$$= 4.0 \times 10^5 \text{ kg m s}^{-1}$$

FIG. 2.24   Example

Direction. The angle θ made by the total impulse with the horizontal or orbit tangent is given by $\tan\theta = U_y/U_x = 100\,000/385\,000 = 0.260$. Thus $\theta = 14.6°$.

Magnitudes of acceleration due to gravity

(i) *Above the earth's surface.* Consider an object of mass m in an orbit of radius R from the centre, where $R > r$, the radius of the earth. Then, if g' is the acceleration due to gravity at this place,

$$mg' = \frac{GmM}{R^2} \qquad . \qquad . \qquad . \qquad (i)$$

---

and if g is the acceleration due to gravity at the earth's surface,

$$mg = \frac{GmM}{r^2} \qquad . \qquad . \qquad . \qquad . \qquad (ii)$$

Dividing (i) by (ii), $\therefore \dfrac{g'}{g} = \dfrac{r^2}{R^2}$, or $g' = \dfrac{r^2}{R^2} \cdot g$.

Thus above the earth's surface, the acceleration due to gravity g' varies inversely as the square of the distance from the centre. Fig. 2.25.

For a height h above the earth, $R = r + h$.

$$\therefore g' = \frac{r^2}{(r+h)^2} \cdot g = \frac{1}{\left(1 + \dfrac{h}{r}\right)^2} \cdot g$$

$$= \left(1 + \frac{h}{r}\right)^{-2} \cdot g = \left(1 - \frac{2h}{r}\right)g,$$

since powers of $(h/r)^2$ and higher can be neglected when h is small compared with r.

$$\therefore g - g' = \text{reduction in acceleration due to gravity.}$$
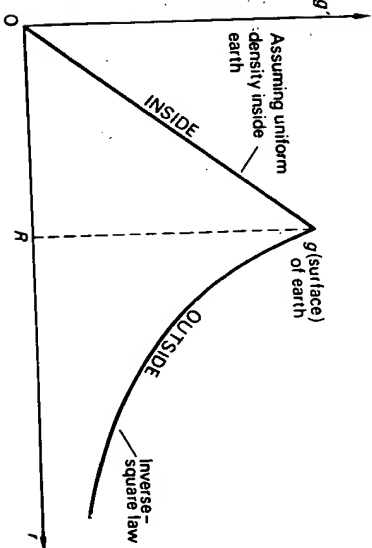
$$= \frac{2h}{r} \cdot g \qquad . \qquad . \qquad . \qquad (1)$$

(ii) *Below the earth's surface.* Consider an object of mass m at a point below the earth's surface. If its distance from the centre is b, the 'effective' mass M' of the earth which attracts it is that contained in a sphere of radius b. Assuming a constant density, then, since the mass of a sphere is proportional to *radius*^{3},

$$M' = \frac{b^3}{r^3} M,$$

FIG. 2.25   Variation of g

close to its surface in an orbit 1. Fig. 2.22 (i). Then, if r is the radius of the earth,

$$\frac{mv^2}{r} = G\frac{Mm}{r^2} = mg,$$

where g is the acceleration due to gravity at the earth's surface and v is the velocity of m in its orbit. Thus $v^2 = rg$, and hence, using r = 6.4×10^6 m and g = 9.8 m s^{-2},

$$v = \sqrt{rg} = \sqrt{6.4 \times 10^6 \times 9.8} = 8 \times 10^3 \text{ m s}^{-1} \text{ (approx)},$$
$$= 8 \text{ km s}^{-1}.$$

The velocity v in the orbit is thus about 8 km s^{-1}. In practice, the satellite is carried by a rocket to the height of the orbit and then given an impulse, by firing jets, to deflect it in a direction parallel to the tangent of the orbit (see p. 66). Its velocity is boosted to 8 km s^{-1} so that it stays in the orbit. The period in orbit

$$= \frac{\text{circumference of earth}}{v} = \frac{2\pi \times 6.4 \times 10^6 \text{ m}}{8 \times 10^3 \text{ m s}^{-1}}$$

$$= 5000 \text{ seconds (approx)} = 83 \text{ min.}$$

Parking Orbits

Consider now a satellite of mass m circling the earth in the plane of the equator in an orbit 2 concentric with the earth. Fig. 2.22 (ii). Suppose the direction of rotation is the same as the earth and the orbit is at a distance R from the centre of the earth. Then if v is the velocity in orbit,

$$\frac{mv^2}{R} = \frac{GMm}{R^2}.$$

But $GM = gr^2$, where r is the radius of the earth.

$$\therefore \frac{mv^2}{R} = \frac{mgr^2}{R^2}$$

$$\therefore v^2 = \frac{gr^2}{R}.$$

If T is the period of the satellite in its orbit, then $v = 2\pi R/T$.

$$\therefore \frac{4\pi^2 R^2}{T^2} = \frac{gr^2}{R}$$

$$\therefore T^2 = \frac{4\pi^2 R^3}{gr^2}. \qquad . \qquad . \qquad . \qquad (i)$$

If the period of the satellite in its orbit is exactly equal to the period of the earth as it turns about its axis, which is 24 hours, the satellite will stay over the same place on the earth while the earth rotates. This

sometimes called a 'parking orbit'. Relay satellites can be placed in parking orbits, so that television programmes can be transmitted continuously from one part of the world to another. *Syncom* was a satellite used for transmission of the Tokyo Olympic Games in 1964.

Since T = 24 hours, the radius R can be found from (i). Thus from

$$R = \sqrt[3]{\frac{T^2 gr^2}{4\pi^2}} \quad \text{and} \quad g = 9.8 \text{ m s}^{-2}, r = 6.4 \times 10^6 \text{ m},$$

$$\therefore R = \sqrt[3]{\frac{(24 \times 3600)^2 \times 9.8 \times (6.4 \times 10^6)^2}{4\pi^2}} = 42400 \text{ km}$$

the height above the earth's surface of the parking orbit

$$= R - r = 42\,400 - 6\,400 = 36\,000 \text{ km.}$$

In the orbit, the velocity of the satellite

$$= \frac{2\pi R}{T} = \frac{2\pi \times 42\,400}{24 \times 3600 \text{ seconds}} = 3.1 \text{ km s}^{-1}.$$

Weightlessness

When a rocket is fired to launch a spacecraft and astronaut into orbit round the earth, the initial acceleration must be very high owing to the large initial thrust required. This acceleration, a, is of the order of 15g, where g is the gravitational acceleration at the earth's surface. Suppose S is the reaction of the couch to which the astronaut is initially strapped. Fig. 2.23 (i). Then, from F = ma, S − mg = ma = m.15g, where m is the mass of the astronaut. Thus S = 16mg. This force is 16 times the weight of the astronaut and thus, initially, he experiences a large force.
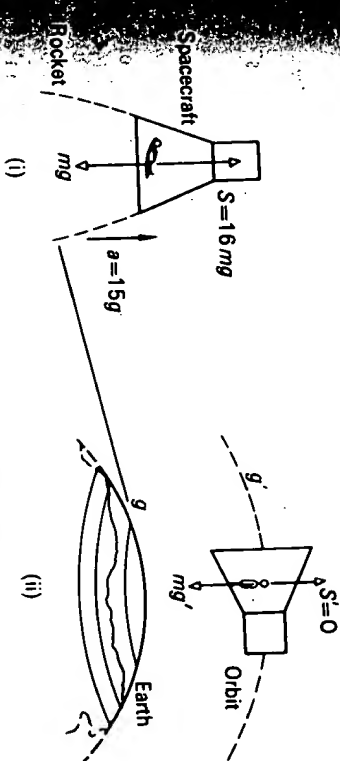

FIG. 2.23 Weight and weightlessness

In orbit, however, the state of affairs is different. This time the -culation of the spacecraft and astronaut are both g' in magnitude,

The constant c can now be calculated, and by substitution in (i), G can be determined. Accurate experiments showed that $G = 6.66 \times 10^{-11}$ N m² kg⁻² and Heyl, in 1942, found G to be 6.67×10^{-11} N m² kg⁻².

Mass and Density of Earth

At the earth's surface the force of attraction on a mass m is mg, where g is the acceleration due to gravity. Now it can be shown that it is legitimate in calculations to assume that the mass, M, of the earth is concentrated at its centre, if it is a sphere. Assuming that the earth is spherical and of radius r, it then follows that the force of attraction of the earth on the mass m is GmM/r^2.

$$\therefore G\frac{mM}{r^2} = mg.$$

$$\therefore g = \frac{GM}{r^2}.$$

$$\therefore M = \frac{gr^2}{G}.$$

Now, $g = 9.8$ m s⁻², $r = 6.4 \times 10^6$ m, $G = 6.7 \times 10^{-11}$ N m² kg⁻².

$$\therefore M = \frac{9.8 \times (6.4 \times 10^6)^2}{6.7 \times 10^{-11}} = 6.0 \times 10^{24} \text{ kg}.$$

The volume of a sphere is $4\pi r^3/3$, where r is its radius. Thus the density, ρ, of the earth is approximately given by

$$\rho = \frac{M}{V} = \frac{gr^2}{4\pi r^3 G/3} = \frac{3g}{4\pi rG}.$$

By substituting known values of g, G, and r, the mean density of the earth is found to be about 5500 kg m⁻³. The density may approach a value of 10000 kg m⁻³ towards the interior.

It is now believed that gravitational force travels with the speed of light. Thus if the gravitational force between the sun and earth were suddenly to disappear by the vanishing of the sun, it would take about 8 minutes for the effect to be experienced on the earth. The earth would then fly off along a tangent to its original curved path.

Gravitational and inertial mass

The mass m of an object appearing in the expression $F = ma$, force = mass × acceleration, is the *inertial mass*, as stated on p. 13. It is a measure of the reluctance of the object to move when forces act on it. It appears in $F = ma$ from Newton's second law of motion.

The 'mass' of the same object concerned in Newton's theory of gravitational attraction can be distinguished from the inertial mass. This is called the *gravitational mass*. If it is given the symbol m_g then $F_g = GMm_g/r^2$, where F_g is the gravitational force, M is the mass of the earth and r its radius. Now $GM/r^2 = g$, the acceleration due to gravity (see above). Thus $F_g = m_g g = W$, the weight of the object.

In the simple pendulum theory on p. 48, we can derive the period T using W = weight = $m_g g$ in place of the symbols adopted there.

Thus

$$-m_g g\frac{y}{l} = ma,$$

or

$$a = -\frac{m_g g}{ml} \cdot y = -\omega^2 y.$$

$$\therefore T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{ml}{m_g g}}$$

Experiments show that to a high degree of accuracy, $T = 2\pi\sqrt{l/g}$ no matter what mass is used, that is, the period depends only on l and g. Thus $m = m_g$, or the gravitational mass is equal to the inertial mass to the best of our present knowledge.

Mass of Sun

The mass M_s of the sun can be found from the period of a satellite and its distance from the sun. Consider the case of the earth. Its period T is about 365 days or $365 \times 24 \times 3600$ seconds. Its distance r_s from the centre of the sun is about 1.5×10^{11} m. If the mass of the earth is m, then, for circular motion round the sun,

$$\frac{GM_s m}{r_s^2} = mr_s\omega^2 = \frac{mr_s 4\pi^2}{T^2},$$

$$\therefore M_s = \frac{4\pi^2 r_s^3}{GT^2} = \frac{4\pi^2 \times (1.5 \times 10^{11})^3}{6.7 \times 10^{-11} \times (365 \times 24 \times 3600)^2} = 2 \times 10^{30} \text{ kg}.$$

Orbits round the earth

Satellites can be launched from the earth's surface to circle the earth. They are kept in their orbit by the gravitational attraction of the earth.
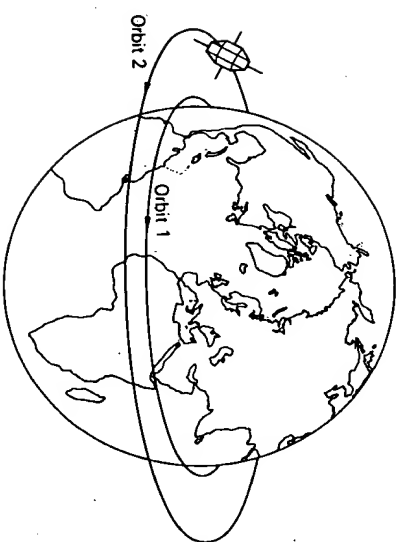

Fig. 2.22   Orbits round earth

Consider a satellite of mass m which just circles the earth of mass M

Unlike the progressive wave, where the energy travels outwards through the medium, Fig. 2.19 (ii), the energy of the stationary wave remains stored in one part of the medium. Stationary waves are produced in musical instruments when they are played. Stationary radio waves are also produced in receiving aerials. Stationary waves, due to electron motion, are believed to be present around the nucleus of atoms.

Interference. Diffraction

A stationary wave is a special case of *interference* between two waves. Another example occurs when two tuning forks of nearly equal frequency are sounded together. A periodic variation of loud sounds called 'beats' is then heard. They are due to the periodic variation of the amplitude of the resultant wave. If two very close coherent sources of light are obtained, interference between the two waves may produce bright and dark bands.

Diffraction is the name given to the interference between waves coming from coherent sources on the same undivided wavefront. The effect is pronounced when a wave is incident on a narrow opening whose width is of comparable order to the wavelength. The wave now spreads out or is 'diffracted' after passing through the slit. If the width of the slit, however, is large compared with the wavelength, the wave passes straight through the opening without any noticeable diffraction. This is why visible light, which has wavelengths of the order of 6×10^{-7} m, passes straight through wide openings and produces sharp shadows; whereas sound, which has wavelengths over a million times longer and of the order of say 0·5 m, can be heard round corners.

Further details of wave phenomena are discussed in the Sound and Optics sections of the book.

GRAVITATION

Kepler's Laws

The motion of the planets in the heavens had excited the interest of the earliest scientists, and Babylonian and Greek astronomers were able to predict their movements fairly accurately. It was considered for some time that the earth was the centre of the universe, but about 1542 COPERNICUS suggested that the planets revolved round the sun as centre. A great advance was made by KEPLER about 1609. He had studied for many years the records of observations on the planets made by TYCHO BRAHE, and he enunciated three laws known by his name. These state:

(1) The planets describe ellipses about the sun as one focus.

(2) The line joining the sun and the planet sweeps out equal areas in equal times.

(3) The squares of the periods of revolution of the planets are proportional to the cubes of their mean distances from the sun.

The third law was announced by Kepler in 1619.

Newton's Law of Gravitation

About 1666, at the early age of 24, NEWTON discovered a universal ... known as the *law of gravitation*.

...was led to this discovery by considering the motion of a planet moving in a circle round the sun S as centre. Fig. 2.20 (i). The force on the planet of mass m is $mr\omega^2$, where r is the radius of the circle and ω is the angular velocity of the motion (p.38). Since $\omega = 2\pi/T$, where T is the period of the motion,

$$\text{force on planet} = mr\left(\frac{2\pi}{T}\right)^2 = \frac{4\pi^2 mr}{T^2}.$$

...is equal to the force of attraction of the sun on the planet. Assuming an inverse-square law, then, if k is a constant,

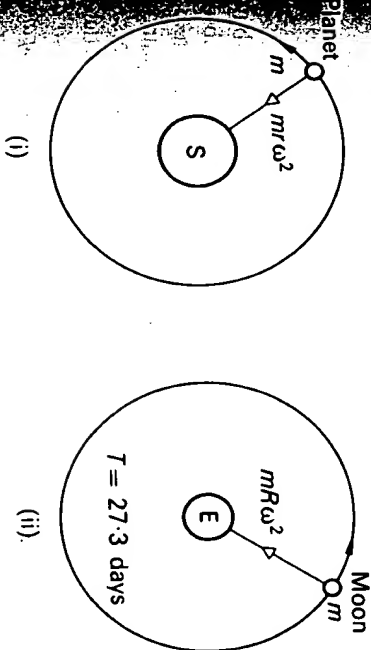Fig. 2.20   Satellites

$$\text{force on planet} = \frac{km}{r^2}.$$
$$\therefore \frac{km}{r^2} = \frac{4\pi^2 mr}{T^2}$$
$$\therefore T^2 = \frac{4\pi^2 r^3}{k}$$
$$\therefore T^2 \propto r^3,$$

...m, π, k are constants.

Now Kepler had announced that the squares of the periods of revolution of the planets are proportional to the cubes of their mean distances from the sun (see above). Newton thus suspected that *the force* between the sun and the planet was inversely *proportional to the square of the distance between them*. The great scientist now proceeded to test the inverse-square law by applying it to the case of the moon's motion

shortened string. Then, if h is the height of the ceiling above the bob initially, $T_1 = 2\pi\sqrt{h/g}$ and $T_2 = 2\pi\sqrt{(h-a)/g}$. Thus

$$h = \frac{gT_1^2}{4\pi^2} \quad \text{and} \quad h - a = \frac{gT_2^2}{4\pi^2}.$$

$$\therefore a = \frac{g}{4\pi^2}(T_1^2 - T_2^2).$$

Thus g can be calculated from a, T_1 and T_2. Alternatively, the period T can be measured for several lengths a. Then, since $T = 2\pi\sqrt{(h-a)/g}$,

$$\therefore g = \frac{4\pi^2 a}{T_1^2 - T_2^2}.$$

$$h - a = \frac{g}{4\pi^2}T^2.$$

A graph of a v. T^2 is thus a straight line whose gradient is $g/4\pi^2$. Hence g can be found. The intercept on the axis of a, when $T^2 = 0$, is h, the height of the ceiling above the bob initially.

The Spiral Spring or Elastic Thread

When a weight is suspended from the end of a spring or an elastic thread, experiment shows that the extension of the spring, i.e., the increase in length, is proportional to the weight, provided that the elastic limit of the spring is not exceeded (see p. 154). Generally, then, *the tension (force), T, in a spring is proportional to the extension x produced*, i.e., $T = kx$, where k is a constant of the spring.

Consider a spring or an elastic thread PA of length l suspended from a fixed point P, Fig. 2.16. When a mass m is placed on it, the spring stretches to O by a length e given by

$$mg = ke, \quad . \quad . \quad . \quad (i)$$

since the tension in the spring is then mg. If the mass is pulled down a little and then released, it vibrates up-and-down above and below O. Suppose at an instant that B is at a distance x below O. The tension T of the spring at B is then equal to $k(e+x)$, and hence the force towards O $= k(e+x) - mg$. Since force $=$ mass $\times$ acceleration,

$$\therefore -[k(e+x) - mg] = ma,$$

the minus indicates that the net force is upward at this instant, whereas the displacement x is measured from O in the opposite direction at the same instant. From this equation,

$$-ke - kx + mg = ma.$$

But, from (i),

$$mg = ke,$$
$$\therefore -kx = ma,$$
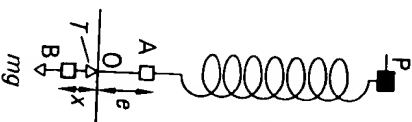$$\therefore a = -\frac{k}{m}x = -\omega^2 x,$$

Fig. 2.16 Spiral spring

where $\omega^2 = k/m$. Thus the motion is simple harmonic about O, and the period T is given by

$$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{m}{k}} \quad . \quad . \quad . \quad (1)$$

since $mg = ke$, it follows that $m/k = e/g$.

$$\therefore T = 2\pi\sqrt{\frac{e}{g}} \quad . \quad . \quad . \quad (2)$$

From (1), it follows that $T^2 = 4\pi^2 m/k$. Consequently a graph of ... m should be a straight line passing through the origin. In practice, when the load m is varied and the corresponding period T is measured, a straight line graph is obtained when T^2 is plotted against ... thus verifying indirectly that the motion of the load was simple harmonic. The graph does not pass through the origin, however, ... owing to the mass and the movement of the various parts of the spring, ... this has not been taken into account in the foregoing theory and we shall now show how g may be found in this case.

Determination of g by Spiral Spring

The mass s of a vibrating spring is taken into account, in addition to the mass m suspended at the end, theory beyond the scope of this book then shows that the period of vibration, T, is given by

$$T = 2\pi\sqrt{\frac{m+\lambda s}{k}} \quad . \quad . \quad . \quad (i)$$

where λ is approximately $\frac{1}{3}$ and k is the elastic constant of the spring. Squaring (i) and re-arranging,

$$\therefore \frac{k}{4\pi^2}T^2 = m + \lambda s \quad . \quad . \quad . \quad (ii)$$

Thus, since λ, k, s are constants, a graph of T^2 v. m should be a straight line when m is varied and T observed. A straight line graph verifies indirectly that the motion of the mass at the end of the spring is simple harmonic. Further, the magnitude of $k/4\pi^2$ can be found from the slope of the line, and hence k can be calculated.

If a mass M is placed on the end of the spring producing a steady extension e less than the elastic limit, then $Mg = ke$.

$$\therefore g = \frac{e}{M} \times k \quad . \quad . \quad . \quad (iii)$$

By attaching different masses to the spring, and measuring the corresponding extension, the magnitude of e/M can be found by plotting e v. M and measuring the slope of the line. This is called the 'static' experiment on the spring. From the magnitude of k obtained in the 'dynamic' experiment when the period was determined for different loads, the value of g can be found by substituting the ...

since PR = $v.\delta\theta$. In the limit, when δt approaches zero, $\delta\theta/\delta t = d\theta/dt = \omega$, the angular velocity. But $v = r\omega$ (p. 36). Hence, since $a = v\omega$,

$$a = \frac{v^2}{r} \text{ or } r\omega^2. \quad . \quad . \quad . \quad (5)$$

Thus an object moving in a circle of radius r with a constant speed v has a constant acceleration towards the centre equal to v^2/r or $r\omega^2$.

Centripetal forces

The force F required to keep an object of mass m moving in a circle of radius $r = ma = mv^2/r$. It is called a *centripetal force* and acts *towards the centre* of the circle. When a stone A is whirled in a horizontal circle of centre O by means of a string, the tension T provides the centripetal force. Fig. 2.3 (i). For a racing car moving round a circular track, the friction at the wheels provides the centripetal force. Planets such as P, moving in a circular orbit round the sun S, have a centripetal force due to gravitational attraction between S and P (p. 59). Fig. 2.3 (ii).
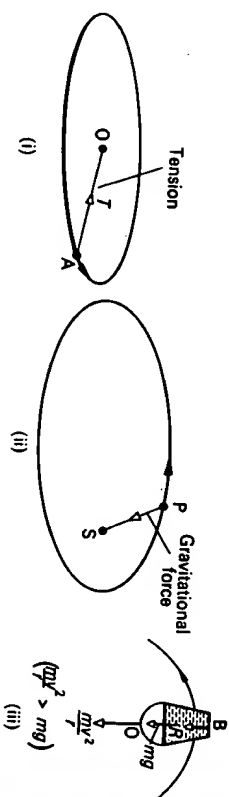

Fig. 2.3 Centripetal forces

If some water is placed in a bucket B attached to the end of a string, the bucket can be whirled in a vertical plane without any water falling out. When the bucket is vertically above the point of support O, the weight mg of the water is less than the required force mv^2/r towards the centre and so the water stays in. Fig. 2.3 (iii). The reaction R of the bucket base on the water provides the rest of the force. If the bucket is whirled slowly and $mg > mv^2/r$, part of the weight provides the force mv^2/r. The rest of the weight causes the water to accelerate downward and hence to leave the bucket.

Centrifuges

Centrifuges are used to separate particles in suspension from the more dense liquid in which they are contained. This mixture is poured into a tube in the centrifuge, which is then whirled at high speed in a horizontal circle.

The pressure gradient due to the surrounding liquid at a particular distance, r say, from the centre provides a centripetal force of $mr\omega^2$ for a small volume of liquid of mass m, where ω is the angular velocity.

If the volume of liquid is replaced by an equal volume of particles of smaller mass m' than the liquid, the centripetal force acting on the particles at the same place is then greater than that required by $m = m')r\omega^2$. The net force urges the particles towards the centre in spiral paths, and here they collect. Thus when the centrifuge is stopped, and the container or tube assumes a vertical position, the suspension is found at the top of the tube and clear liquid at the bottom. Conversely, particles suspended in a *less* dense liquid collect at the bottom of the tube in a centrifuge, leaving clear liquid at the top.

Motion of Bicycle Rider Round Circular Track

When a person on a bicycle rides round a circular racing track, the frictional force F at the ground provides the inward force F towards the centre or centripetal force. Fig. 2.4. This produces a moment about his centre of gravity G which is counterbalanced, when he leans inwards, by the moment of the normal reaction R. Thus provided no skidding occurs, $F.h = R.a = mg.a$, since $R = mg$ for no vertical motion.

Fig. 2.4 Rider on circular track

$$\therefore \frac{a}{h} = \tan\theta = \frac{F}{mg},$$

where θ is the angle of inclination to the vertical. Now $F = mv^2/r$.

$$\therefore \tan\theta = \frac{v^2}{rg}.$$

When F is greater than the limiting friction, skidding occurs. In this case $F > \mu mg$, or $mg \tan\theta > \mu mg$. Thus $\tan\theta > \mu$ is the condition for skidding.

Motion of Car (or Train) Round Circular Track

Suppose a car (or train) is moving with a velocity v round a horizontal circular track of radius r, and let R_1, R_2 be the respective normal re-
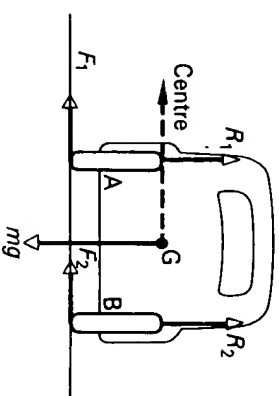

Fig. 2.5 Car on circular track

chapter two

Circular motion. S.H.M. Gravitation

In the previous chapter we discussed the motion of an object moving in a straight line. There are numerous cases of objects moving in a *curve* about some fixed point. The earth and the moon revolve continuously round the sun, for example, and the rim of the balance-wheel of a watch moves to-and-fro in a circular path about the fixed axis of the wheel. In this chapter we shall study the motion of an object moving in a circle with a *uniform speed* round a fixed point O as centre, Fig. 2.1.
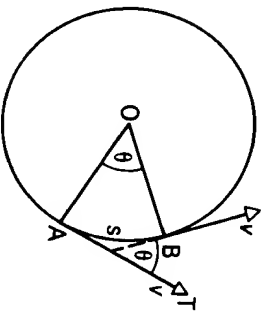
If the object moves from A to B so that the radius OA moves through

FIG. 2.1 Circular motion

an angle θ, its *angular velocity*, ω, about O is defined as the *change of the angle per second*. Thus if t is the time taken by the object to move from A to B,

$$\omega = \frac{\theta}{t} . \qquad . \qquad . \qquad . \qquad (1)$$

Angular velocity is usually expressed in 'radian per second' (rad s^{-1}).

Angular Velocity

From (1),

$$\theta = \omega t . \qquad . \qquad . \qquad . \qquad (2)$$

which is analogous to the formula 'distance = uniform velocity × time' for motion in a straight line. It will be noted that the time T to describe the circle once, known as the *period* of the motion, is given by

$$T = \frac{2\pi}{\omega}, \qquad . \qquad . \qquad . \qquad (3)$$

since 2π radians = 360° by definition.

If s is the length of the arc AB, then $s/r = \theta$, by definition of an angle in radians.

$$\therefore s = r\theta.$$

Dividing by t, the time taken to move from A to B,

$$\therefore \frac{s}{t} = r\frac{\theta}{t}.$$

But $s/t =$ the *speed*, v, of the rotating object, and θ/t is the angular velocity.

$$\therefore v = r\omega \qquad . \qquad . \qquad . \qquad (4)$$

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Acceleration in a circle

When a stone is attached to a string and whirled round at constant speed in a circle, one can feel the force in the string needed to keep the stone moving. The presence of the force, called a *centripetal force*, implies that the stone has an acceleration. And since the force acts towards the centre of the circle, the direction of the acceleration, which is a vector quantity, is also towards the centre.

To obtain an expression for the acceleration towards the centre, consider an object moving with a constant speed v round a circle of radius r, Fig. 2.2 (i). At A, its *velocity* v_A is in the direction of the tangent. A short time δt later at B, its velocity v_B is in the direction of the tangent BD. Since their directions are different, the velocity v_B is different from the velocity v_A, although their magnitudes are both equal to v. Thus a velocity change or acceleration has occurred from A to B.
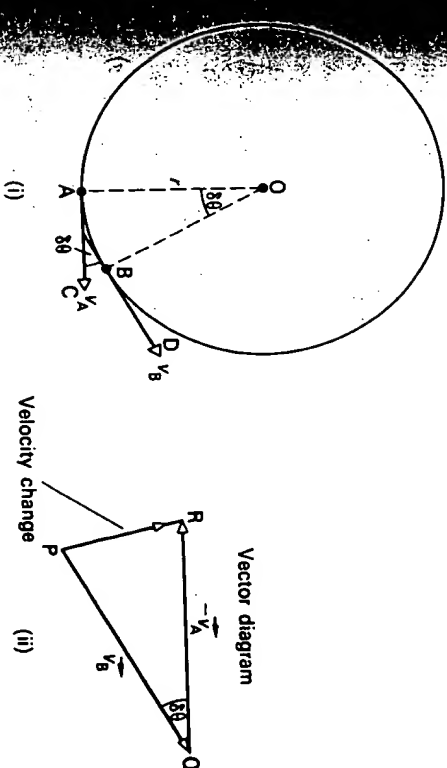

FIG. 2.2 Acceleration in circle

The velocity change from A to B = $\vec{v}_B - \vec{v}_A = \vec{v}_B + (-\vec{v}_A)$. The arrows denote vector quantities. In Fig. 2.2 (ii), PQ is drawn to represent v_B in magnitude (v) and direction (BD); QR is drawn to represent v_A in magnitude (v) and direction (CA). Then, as shown on p. 11, ($-\vec{v}_A$) in magnitude (v) and direction is

velocity change = $\vec{v}_B + (-\vec{v}_A) = \vec{PR}$.

When δt is small, the angle AOB or $\delta\theta$ is small. Thus angle PQR, equal to $\delta\theta$, is small. PR then points towards O, the centre of the circle. *The velocity change or acceleration is thus directed towards the centre.*

The magnitude of the acceleration, a, is given by

$$a = \frac{\text{velocity change}}{\text{time}} = \frac{\text{PR}}{\delta t}.$$

$$= \frac{v.\delta\theta}{\delta t}.$$

Coefficient of restitution

In practice, colliding objects do not stick together and kinetic energy is always lost. If a ball X moving with velocity u_1 collides head-on with a ball Y moving with a velocity u_2 in the same direction, then Y will move faster with a velocity v_1 say and X may then have a reduced velocity v_2 in the same direction. The co-efficient of restitution, e, between X and Y is defined as the ratio:

$$\frac{\text{velocity of separation}}{\text{velocity of approach}} \quad \text{or} \quad \frac{v_2 - v_1}{u_1 - u_2}$$

The coefficient of restitution is approximately constant between two given materials. It varies from $e = 0$, when objects stick together and the collision is completely inelastic, to $e = 1$, when objects are very hard and the collision is practically elastic. Thus, from above, if $u_1 = 4$ m s^{-1}, $u_2 = 1$ m s^{-1} and $e = 0.8$, then velocity of separation, $v_2 - v_1 = 0.8 \times (4 - 1) = 2.4$ m s^{-1}.

Momentum and Explosive forces

There are numerous cases where momentum changes are produced by *explosive* forces. An example is a bullet of mass $m = 50$ g say, fired from a rifle of mass $M = 2$ kg with a velocity v of 100 m s^{-1}. Initially, the total momentum of the bullet and rifle is zero. From the principle of the conservation of linear momentum, when the bullet is fired the total momentum of bullet and rifle is still zero, since no external force has acted on them. Thus if V is the velocity of the rifle,

$$mv \,(\text{bullet}) + MV \,(\text{rifle}) = 0$$

$$\therefore MV = -mv, \quad \text{or} \quad V = -\frac{m}{M}v.$$

The momentum of the rifle is thus *equal and opposite* to that of the bullet. Further, $V/v = -m/M$. Since $m/M = 50/2000 = 1/40$, it follows that $V = -v/40 = 25$ m s^{-1}. This means that the rifle moves back or *recoils* with a velocity only about $\frac{1}{40}$th that of the bullet.

If it is preferred, one may also say that the explosive force produces the same numerical momentum change in the bullet as in the rifle. Thus $mv = MV$, where V is the velocity of the rifle in the *opposite* direction to that of the bullet. The joule (J) is the unit of energy (p. 24).

The kinetic energy, E_1, of the bullet $= \frac{1}{2}mv^2 = \frac{1}{2} . 0.05 . 100^2 = 250$J
The kinetic energy, E_2, of the rifle $= \frac{1}{2}MV^2 = \frac{1}{2} . 2 . 2.5^2 = 6.25$J
Thus the total kinetic energy produced by the explosion $= 256.25$ J. The kinetic energy E_1 of the bullet is thus 250/256.25, or about 98% of the total energy. This is explained by the fact that the kinetic energy depends on the *square* of the velocity. The high velocity of the bullet thus more than compensates for its small mass relative to that of the rifle. See also p. 26.

Rocket

Consider a rocket moving in outer space where no external forces act on it. Suppose its mass is M and its velocity is v at a particular instant. Fig. 1.18 (i). When a mass m of fuel is ejected, the mass of the rocket becomes $(M - m)$ and its velocity increases to $(v + \Delta v)$. Fig. 1.18 (ii).
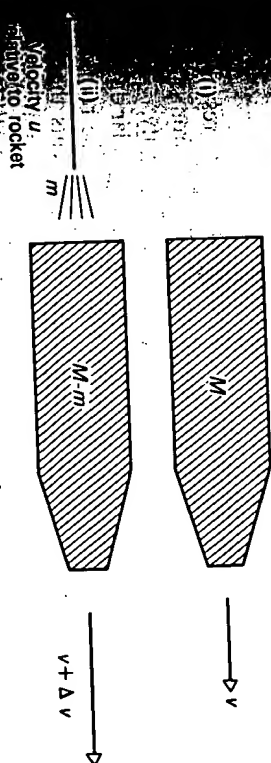
FIG. 1.18. Motion of rocket

Suppose the fuel is always ejected at a constant speed u relative to the rocket. Then the velocity of the mass $m = v + \frac{\Delta v}{2} - u$ in the direction of the rocket. Then the initial velocity of the rocket is v and the final velocity is $v + \Delta v$, an average of $v + \Delta v/2$.

... the fuel is ejected, momentum of rocket $= (M - m)(v + \Delta v)$

and momentum of fuel $= m\left(v + \frac{\Delta v}{2} - u\right)$.

We now apply the principle of the conservation of momentum to the rocket and fuel. Initially, before m of fuel was ejected, momentum of rocket and fuel $= Mv$.

... m is ejected, momentum of rocket $= Mv$.

$$\therefore (M - m)(v + \Delta v) + m\left(v + \frac{\Delta v}{2} - u\right) = Mv.$$

Neglecting the product of $m . \Delta v$, then, after simplification,

$$M.\Delta v - mu = 0,$$

$$\therefore \frac{m}{M} = \frac{\Delta v}{u}.$$

$m = $ mass of fuel ejected $= -\Delta M$,

Now

$$\therefore -\frac{\Delta M}{M} = \frac{\Delta v}{u}.$$

Integrating between limits of M, M_0 and v, v_0 respectively

$$\therefore \int_{M_0}^{M} -\frac{\Delta M}{M} = \frac{1}{u}\int_{v_0}^{v} \Delta v$$

$$\therefore -\log_e \frac{M}{M_0} = \frac{v - v_0}{u}$$

$$\therefore M = M_0 e^{-(v-v_0)/u} \qquad . \qquad . \qquad (1)$$

$$v = v_0 - u\log_e(M/M_0) \qquad . \qquad (2)$$

When the mass M decreases to $M_0/2$

$$v = v_0 + u\log_e 2.$$

Advanced Level Physics

Third edition with SI units

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INTERNATIONAL SEARCH REPORT

P- 1

International Application No

PCT/IB 99/00178

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6   F02B75/26   F02B57/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6   F02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 252 764 A (COIGNARD) 20 June 1975 (1975-06-20)	1-10, 20-22, 27,29, 30,32
A	figures 1,2 page 2, line 14 - page 4, line 15	14-18, 23,24
X	FR 2 229 274 A (BOEUF PAUL) 6 December 1974 (1974-12-06) figure 1 page 1, line 1 - page 2, line 20	1-10,26, 31,32
A	US 4 127 096 A (TOWNSEND RAY T) 28 November 1978 (1978-11-28) figure 1 abstract column 6, line 16 - line 38	1,11,15, 19

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[X] Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

25 May 1999

Date of mailing of the international search report

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	AU 59802 86 A (BULLMORE E A) 15 January 1987 (1987-01-15) figures 1-3 abstract claims 1-10	1,11,15, 30-32
A	NL 7 310 257 A (JOHANNES HALFHIDE PR BEATRIXHO) 28 January 1975 (1975-01-28) figures 1-3 claims 1-7	1-10
A	FR 2 086 778 A (LE DUIGO ROGER) 31 December 1971 (1971-12-31) figure 1 page 3, line 1 - line 35	1-10
A	FR 1 378 232 A (MINGUEZ) 22 February 1965 (1965-02-22) figure 1 abstract	1-10
A	US 4 009 695 A (ULE LOUIS A) 1 March 1977 (1977-03-01) figure 1 abstract	1,23,25, 26,28

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P. 3

INTERNATIONAL SEARCH REPORT
Information on patent family members

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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FR 2229274	A	06-12-1974	NONE		
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FR 1378232	A	22-02-1965	NONE		
US 4009695	A	01-03-1977	NONE		

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PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

AL PASHA AL BAHDAINI, Shirwan
Rue David Dufour 8
CH-1205 Genève
SUISSE

Date of mailing (day/month/year) 03 December 1999 (03.12.99)	
Applicant's or agent's file reference	**IMPORTANT NOTIFICATION**
International application No. PCT/IB99/00178	International filing date (day/month/year) 29 January 1999 (29.01.99)

---

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address AL PASHA AL BAHDAINI, Shirwan 16, avenue Théodore-Vernes CH-1290 Versoix Switzerland	State of Nationality IQ	State of Residence CH
	Telephone No.	
	Facsimile No. 0041-22-9391203	
	Teleprinter No.	

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2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

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3. Further observations, if necessary:

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Date of mailing (day/month/year) 13 October 1999 (13.10.99)	
International application No. PCT/IB99/00178	**Applicant's or agent's file reference**
International filing date (day/month/year) 29 January 1999 (29.01.99)	**Priority date** (day/month/year) 30 January 1998 (30.01.98)

Applicant

AL PASHA AL BAHDAINI, Shirwan

1. The designated Office is hereby notified of its election made:

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    <u>30 August 1999 (30.08.99)</u>

    [ ] in a notice effecting later election filed with the International Bureau on:

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